SCIENTIFIC AMERICAN

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HIGH-SERVICE WATER TOWER, BROOKLYN.

A large section of the city of Brooklyn, near the main entrance to and along the southwestern boundary of Prospect Park, is on pretty high ground, and on this account an important distributing reservoir was located here many years ago. The water level of this reservoir is 198 feet above tide water, and its service has been of an entirely satisfactory character for the area it was intended to supply with water, for at the time the reservoir was constructed the high ground in the neighborhood of the park was almost entirely unoccupied, and the level of the built-up section of the city was so much lower that a good water pressure for house service was easily maintained. In but few large cities, however, has there been such a steady and substantial growth as has been characteristic of Brooklyn for several years past, and the entire region lying directly around the reservoir, with still higher portions along the park border, is now being occupied as a residence section, a great part of it being already covered by handsome brownstone structures. The site is a commanding one, as from "Reservoir Hill" the view takes in the larger portion of the two cities of New York and Brooklyn, as well as New York Bay and the Narrows, out to the Atlantic Ocean, and its value is greatly enhanced by the fact that a large portion of this high land borders upon one of the most beautiful parks in the world, the main entrance to which forms the subject of our illustration.

The new high-service water tower now being completed, and which forms a prominent feature of the picture, is designed to supply the water for house service for this neighborhood, the pressure afforded by the old reservoir being insufficient to cause the water to flow above the first or second stories in buildings occupying the highest sites. The tower is located at one corner of the old reservoir, and is built of Connecticut red granite. It has an extreme height of 166

(*Continued on page 149.*)

THE NEW HIGH-SERVICE WATER TOWER, BROOKLYN, N. Y., AND PROSPECT PARK PLAZA.

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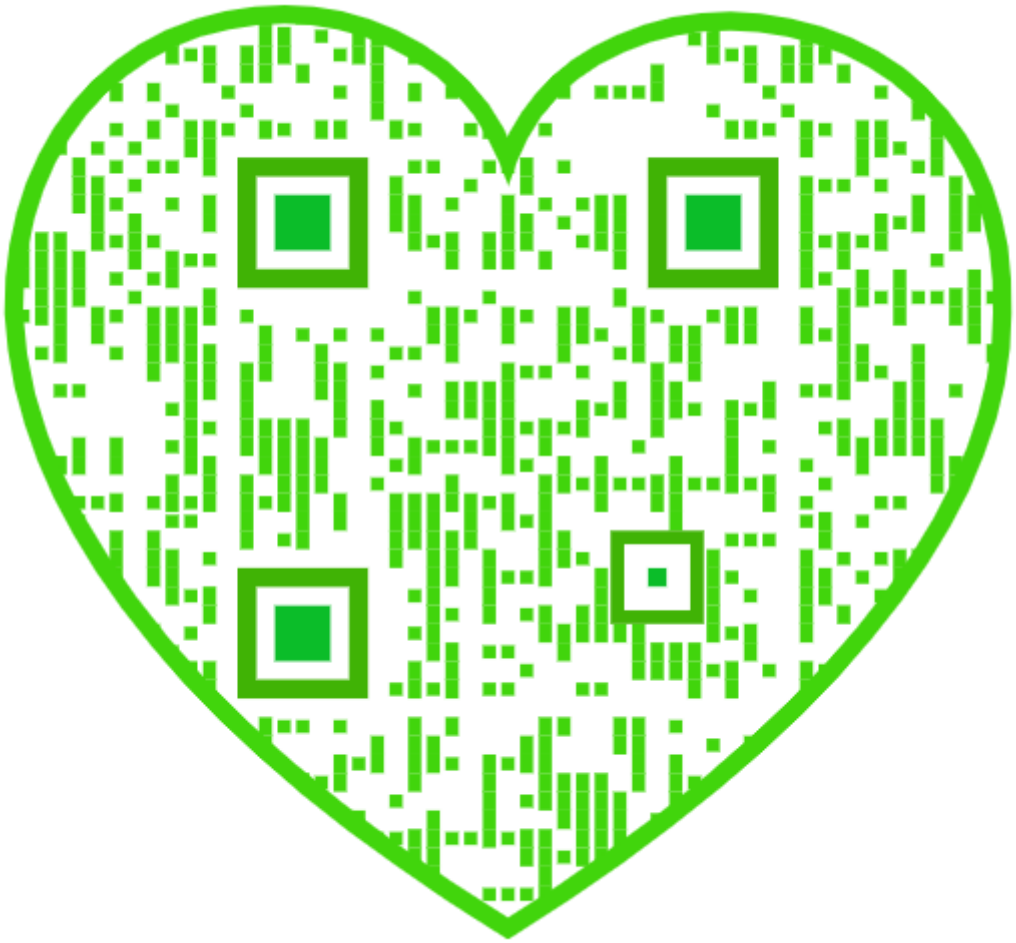

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NEW YORK, SATURDAY, SEPTEMBER 3, 1892.

Contents.

(Illustrated articles are marked with an asterisk.)

Air Ship, Barnes'*..... 150
Aluminum, Soldering Metal for 147
American Association Meeting.. 144
Bauxite, American..... 152
Books and Publications, New.... 154
Brooklyn, Prospect Park Plaza*. 143
Cement, Universal..... 149
Clock, Smallwood's Sixteen Dial* 150
Coffin Lowering Apparatus, Beugler's*..... 146
Dating Stamp, the "Expert"*... 146
Electric Illumination, Masthead* 151
Engineering Inventions, Recent 154
Engine, Rotary, Betten's.*..... 146
Fuse Igniter, Doyle's*..... 146
Golden Door, World's Fair*..... 153
India Rubber, Borneo..... 152
Industry, discouragement..... 148
Inventions, Recently Patented.. 154
Leather and Shoes at the Fair.. 152
Light, electric, Mt. Washington. 145
Locomotive Performances..... 149
Males and Females, Proportions of by Census..... 145
Moss, Florida..... 149
Notes and Queries..... 154
Oak, a new hybrid..... 145
Patents granted, a weekly record of..... 155
Pathological Models, Material for..... 153
Paving Estimates..... 149
Photometer, Van Choate's*..... 148
Physician, the Ideal Family..... 153
Planets, Position of, September. 145
Plaster of Paris..... 147
Railway appliances, some new... 154
Road Cleaner, Pneumatic, Astor's*..... 147
Snow for Irrigation..... 152
Soils, Mechanical Properties of.. 153
Speech, Apparatus for Inscribing*..... 151
Steamers, New Atlantic..... 150
Steel process, Casson's..... 148
Tools of pyramid builders..... 148
Velocity of a Cannon Ball..... 147
Wages, miners', Hungary..... 145
Water Tower, High Service, Brooklyn*..... 143
Waterway, Chicago-Mississippi.. 148
Whaler, a, at the Fair..... 146
World's Fair, Grand Entrance to Transportation Building*..... 153

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 870.

For the Week Ending September 3, 1892.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ARCHITECTURAL.—The Imperial Institute, London.—1 large engraving..... 13898

II. ASTRONOMICAL.—Planetary Nebulæ.—By Miss A. M. CLERKE, Authoress of "A Popular History of Astronomy during the Nineteenth Century," and "The System of the Stars."..... 13909

III. BIOGRAPHY.—Hiram Sibley.—An address delivered by R. H. THURSTON, director of Sibley College, Cornell University, June 15, 1892, on the occasion of the unveiling of a bust of the founder of the institution, in the Chapel of Cornell University..... 13902
The Life of Dr. P. H. Vander Weyde.—An autobiography.—Chapter II.—4 engravings..... 13903

IV. The Ascent of Sap in Flowers..... 13905
Observations on the Scent of Flowers..... 13906
Monsetra Deliciosa..... 13906

V. CHEMICAL.—Action of Nitric Oxide upon the Metallic Oxides.—By MM. PAUL SABATIER and J. B. SENDERENS..... 13901
On Peroxide of Hydrogen.—A physical-medical research.—By BENJAMIN WARD RICHARDSON, M.D., F.R.S.—Continued from SUPPLEMENT, No. 867..... 13906

VI. ELECTRICAL.—Oakland, San Leandro and Haywards Electric Railway..... 13899

VII. MARINE ENGINEERING.—The Modern Marine Boiler.—By A. B. WILLITS, U. S. N..... 13895

VIII. MECHANICAL.—Port's Universal Wrench.—A description of a wrench that may be converted into five separate tools.—5 engravings..... 13897
Block Signals.—Read at the eleventh annual meeting of the Railway Telegraph Superintendents, Denver, Col.—By J. B. STEWART..... 13897

IX. MISCELLANEOUS.—Prison Reform.—By TANCRED CANONICO, Senator of Italy.—A full paper on the origin and development of prison reform..... 13900
Explorations at Copan, Honduras.—By Mr. M. H. SAVILLE.—Read before the American Association for the Advancement of Science, Rochester meeting, August, 1892..... 13904
A Poet Inventor..... 13905
Nancy Hanks, the Fastest Trotter.—2 illustrations..... 13905
Tobacco, Insanity, and Nervousness.—By Dr. L. BREMER..... 13908
The Emperor William's Whaling Cruise.—An account of the experiences of the German emperor at Skaaro.—2 engravings..... 13895
Syphilis and Cigars..... 13909

X. PHOTOGRAPHY.—Electric Lighting of Photographic Laboratories.—4 engravings..... 13899

XI. TECHNOLOGY.—The Manipulation of Metal in the Manufacture of Ammunition for Modern Breech-loading Rifles.—By S. W. ARMINE, Whitestone, L. I.—Illustrated by 9 engravings..... 13896

XII. WORLD'S FAIR.—Mineralogical Exhibit at the World's Fair.—A paper read by GEO. F. KUNZ at the Rochester meeting of the American Association for the Advancement of Science, August, 1892..... 13904

THE ROCHESTER MEETING OF THE AMERICAN ASSOCIATION.

In one respect the transactions of the American Association for the Advancement of Science might be made more available, if not more valuable, by following the example set by the American Society of Civil Engineers. The latter issues in advance, strictly for private use, official abstracts of all papers to be read. The result is to shut off much desultory discussion, to embody in more definite shape the work done, to make accessible the substance of papers that one fails to hear, and finally to facilitate the work of conscientious reporters trying to gather crumbs from the intellectual feast for the general public. The present plan is bewildering. Every morning a printed programme is distributed with lists of topics for the eight sections, and a definite time allotted to each topic. Practically the programme is trifled with. A paper may get an hour for which only fifteen minutes had been allowed, or the whole order may be set aside to suit some whim. We went to a certain section anxious to hear certain papers that had been announced, but not one of which was read. We were treated instead to a rambling discussion, not on the programme, that was prolonged until noon, and our morning was wasted. Men of science should be men of system and should stick to their programme.

Among the many papers that were presented, 182 in all, we can only notice a few. In the chemical section, an important topic discussed was "The Post-mortem Imbibition of Arsenic." The paper was by Dr. W. P. Mason, of Troy. He asserted that in some cases, where an autopsy had showed arsenic in the stomach and other organs, its presence might possibly be accounted for by imbibition after death. In proof of this he cited an instance in which a person was supposed to have been poisoned, because arsenic had been found in the stomach. It was testified, however, that cloths saturated with an embalming fluid had been laid on the face and other parts of the body. This fluid contained zinc as well as arsenic. Tests were applied and both metals were detected. In the discussion on this paper several similar cases were described, all going to show that metallic poisons may be absorbed through the pores of the skin after death so as to be found in appreciable quantities in the interior organs. The bearing of this on medical jurisprudence is obvious.

Professor George E. Hale explained to the astronomical section the working of the spectroheliograph, and the results of the study of the sun by its means at the Kenwood Astro-physical Observatory, at Chicago. The lantern illustrations were admirable, being undoubtedly the most accurate photographs yet taken of the sun. A series of slides showed the rapidly succeeding phenomena of an enormous solar eruption. First was shown a large black spot shaped quite like a terrestrial volcano. Next was seen the same, only a vast fiery cloud rolled up from the crater, by which the spot was entirely concealed from view. The shape of the fiery mass changed incessantly, marked differences being visible even in photographs taken only one minute apart. The entire activity lasted but an hour and forty minutes; at the end of which time the original black spot reappeared hardly modified in either shape or magnitude.

Professor R. T. Hill, of Texas, read an extended paper on "The Volcanoes of the United States." Tropical America presents some of the most superb volcanic spectacles in the world. In Ecuador are twenty volcanoes from 16,000 to 22,500 feet high, eighteen of them being crowned with eternal snow, and eleven had never been scaled by any living creature. Fifty more exist in the Central American region, and twenty-one in Mexico, chief of which is the lordly Popocatapetl. The peninsula of Southern California is a mass of ancient volcanic debris, with many craters still smoking. Only in April, 1892, the earthquake shocks from one of these shook the whole State of California. The volcanic field of the United States extends from California through Arizona and New Mexico, and northward through Idaho, Oregon and Washington. Hundreds of lava flows can be traced, and vast piles of ashes rise above the plains higher than the combined heights of the Eiffel Tower and Washington Monument. Should Mount Capulin become active again, its flames would be visible from Denver to Galveston. Scores of extinct volcanoes are visible in the vicinity. Around the San Francisco mountains extends a lava field covering 20,000 square miles and including over three hundred peaks.

In Southern Utah stands Mount Filmore and other volcanic cones of still more recent date, and farther to the north are the lava beds of the Modocs. Skirting the east front of the Sierras are volcanic openings whose forces seem to be only slumbering. The great range terminates in Northern California with Mount Shasta, Mount Hood, Mount Adams, Mount Rainier and Mount Baker. We must go further north to see the most interesting volcanic features of our country, in Alaska and its islands, whose sixty-one volcanoes have been in eruption more than fifty times during the last three hundred years. Outside of Alaska it is impossible to say when the last eruption took place in the United States; but many believe it to have been within the last two hundred years.

Some problems of the iron ore found in the Mesabi range in Minnesota were discussed by Professor N. H. Winchell. He claimed that the theory of the substitution of iron for limestone was opposed by the non-existence of any limestone in the region. Also that the idea of a change from carbonate of iron to the oxide of iron was opposed by the non-discovery of any spathic iron in the formation, even in any of the deep borings passing through the ore horizon. The decay of ferriferous schists is negatived because of the absence of any schists contiguous to the ore. Accumulation in troughs formed by dikes cutting tilted strata is impossible, because no such dikes occur in the region. The geological relations of these ores and their kinds were described. There is but one known cause acting with sufficient force on sufficiently wide geographic area to explain the distribution of this ore, and that is oceanic sedimentation. It is evident that there has been a profound change; but whether it took place before or after consolidation, and whether in Taconic or in recent time, is unknown. There seems to have been something peculiar either in the nature of the sediments of this horizon or in the influences to which they have been subjected, and this peculiarity is expressed on both sides of the Lake Superior basin.

A paper was read by Professor E. D. Cope, on the "Cenozoic Beds of the Staked Plains of Texas." This vast plain, covering 50,000 square miles, has a gentle synclinal structure, depressed to the east, overlying beds of the Triassic and Permian, and was once occupied by a fresh lake with changeable boundaries. There are no springs, but the underlying clays are watertight and can be reached anywhere in two or three hundred feet. The northern and eastern edges are cut by canyons resembling in color and stratigraphy the features of the Grand Canyon of the Colorado. The edge of the plain is marked generally by a steep palisade. Professor Cope found three horizons of the Cenozoic. The Equus beds are considered identical with the Lafayette formation. No marine fossils were found anywhere. In the Equus beds were the remains of two species of horses and also elephants. In the Blanco beds occur three species of mastodons, and one of megalonyx. In the Loop Fork beds occur three-toed horses along with mastodons.

The Lafayette formation referred to above was more fully described as to its continental distribution by Mr. W. J. McGee. It is one of the most recent and also extensive formations known. It extends from Baltimore to Florida, thence across to the Mississippi, and up the valley of that river as far as Southern Illinois, and across to New Mexico. The formation exposes about 100,000 square miles, with about twice as much more overlaid by the Columbia and other formations. Its thickness varies from fifty to three hundred feet, and its color changes from a dark red loam to a whitish marl. The poverty in fossils makes its determination difficult, but it is thought to be in general a littoral deposit. The lessons which it has to teach have an important bearing on the subject of continental evolution.

Professor McGee also read an important paper on comparative chronology. He considered the subject: First, with reference to natural time limits—the day, month, year, chang, narus, and Platonic year. Second, historical eras, as determined by rhythmic and cyclic motions, the conjunction of cosmic bodies, and also by artificial eras, dating from catastrophes, the founding of nations or from great religious events. Third, biologic periods, indicated by the introduction of different forms of life, from its faintest signs up to man, which cannot be reduced directly to cosmic or historic terms. Fourth, the geologic periods, which can only be approximately correlated with historic or cosmic terms. This portion of the paper was illustrated by ingenious diagrams, without which it might be difficult to make the author's meaning clear. He discussed in a spirit of fairness the controversy between the geologist and the physicist—the former demanding a hundred times as much as the latter is willing to grant. He believed it to be the office of anthropology to mediate between the two extremes. In reply to an inquiry, he said that the antiquity of man probably extended only about ten thousand years into the past, and that of his anthropoid progenitor about forty thousand years.

Appropriately following the above was a highly original and valuable article by Prof. W. H. Holmes, on the aboriginal quarries of flakable stone, and their bearing upon the question of palæolithic man. The conclusion reached by the author, and generally concurred in by others, was that in view of ascertained facts, the matter needed thorough revision, and that every case arising should be decided on its own merits.

An illustrated lecture was given in Music Hall by Prof. G. K. Gilbert, of the United States Geological Survey, on "Coon Butte, and Theories of its Origin." This is the locality to which attention was called in connection with the last annual meeting, since when Prof. Gilbert and Mr. Marcus Baker had visited it, in order to

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determine its origin. The impression which had previously prevailed that this remarkable butte, found in Arizona near to the Canyon Diablo, was caused by the fall of a meteorite, gave way before a volcanic theory which was established as correct.

The next annual meeting of the A. A. A. S. will be held in August, 1893, at Madison, Wis. Prof. William Harkness, of Washington, D. C., was elected president; Prof. F. W. Putnam, of Cambridge, Mass., permanent secretary; T. H. Norton, of Cincinnati, general secretary; and H. L. Fairchild, of Rochester, secretary of the council. Officers were also chosen for the various sections. It was announced that an anthropological congress would be held at the Columbian Exposition during the week following the next annual meeting of the A. A. A.S., with representatives of every American tribe, from Terra del Fuego to the Esquimaux of the Arctic zone. As an outgrowth of this congress, it is meant to found a museum of ethnology at Chicago, materials for which are now being collected by the ship load in Yucatan, Ecuador, Peru, Chile and elsewhere. A committee was appointed to secure rooms for the various sections of the A. A. A. S. to be used as headquarters during the entire period of the exposition, each room to be in the building the contents of which are most closely allied to the branch of science represented.

In connection with, and at the close of, the Rochester meeting, delightful excursions were made to Niagara Falls, Watkins Glen, Stony Brook Glen, the State Fish Hatchery near Mumford, to Mount Morris, Portage, and other localities. At the closing session Secretary Putnam announced that 65 members had been made fellows at this meeting; that 175 new members had been elected, and that 456 members and fellows had been registered as in attendance.

In our SUPPLEMENT this week will be found an interesting paper read before the association on explorations at Copan, Honduras, by Mr. M. H. Saville, and also a paper on mineralogical exhibits at the World's Fair, by Mr. Geo. F. Kunz.

POSITIONS OF THE PLANETS IN SEPTEMBER.

MARS

is evening star. His great work is accomplished, for the opposition of 1892 is an event of the past. He made his neighborly call, nearly a month since, and is now speeding his course away from the earth, while his ruddy luster is fading, and his marvelous size is diminishing. We place him first on the September annals on account of the widespread popular interest aroused by his unusual appearance. It is to be hoped that full reports may speedily be received from all the observatories that have made a specialty of the study of the Martian planet, and that thus all unreasonable expectations may be laid to rest. There are two points among the problems concerning Mars that are of special interest. One is the solution of the question regarding the nature of the so-called canals and their doubling. The other is the displacement of Mars among the stars at the time of opposition, in order to determine the solar parallax. When the observatories on both sides of the Atlantic have made full reports, and when these reports have been corrected, compared, and made into maps, we may hope to learn something of what was really seen on the face of Mars in the opposition of 1892. The earliest time to look for reliable tidings is in October, and the addition to our knowledge of the Martian planet will probably be small.

Mars contributes an important event to the record of the month. He is in perihelion, or nearest the sun, on the 7th at 3 h. 53 m. P. M., when he is 13,000,000 miles nearer the sun than when he is in aphelion or most distant from the sun. If perihelion and opposition had occurred together, Mars would have been a more distinguished object, but the most perfect conditions united are rare in celestial phenomena. The war god was satisfactory, though not arrayed in his most gorgeous garments.

Mars is stationary on the 4th, and then changes his course, moving eastward or in direct motion for the rest of the year.

OCCULTATION OF MARS.

The moon, two days before the full, occults Mars on the 4th, the planet disappearing on the dark edge of the moon. The phenomenon will be visible in Washington and vicinity. The immersion in Washington mean time takes place, on the 4th, at 1 h. 22 m. A. M., and the emersion at 2 h. 6 m. A. M., the occultation continuing 44 m.

The moon is in conjunction with Mars on the 4th at 0 h. 50 m. A. M., being 44′ north.

The right ascension of Mars on the 1st is 20° 45′, his declination is 24° 17′ south, his diameter is 24″.0, and he is in the constellation Capricornus.

Mars sets on the 1st at 2 h. 26 m. A. M. On the 30th he sets at 1 h. 1 m. A. M.

VENUS

is morning star. She will be superb in the September morning sky, rising about four hours before the sun. Her luster is, however, fading, though it will take bright eyes to perceive it. She reaches her greatest western elongation on the 19th, at 1 h. A. M., when she is 46° 5′ west of the sun. Henceforth, she will approach him, rise later, change from retrograde to direct motion, and slowly make her way toward the sun, until she is lost in his brilliant beams. When the year closes, she is still morning star.

The moon, four days before her change, is in conjunction with Venus, on the 16th, at 4 h. 56 m. P. M., being 7° 36′ north.

The right ascension of Venus on the 1st is 7 h. 44 m., her declination is 17° 25′ north, her diameter is 29″.8, and she is in the constellation Gemini.

Venus rises on the 1st at 1 h. 53 m. A. M. On the 30th she rises at 2 h. 7 m. A. M.

JUPITER

is morning star. If Mars takes the first place on account of the great expectations aroused in the popular mind that important discoveries were obtained during his recent opposition, and Venus wins the second place from her exceeding beauty as morning star, Jupiter merits the third place, for he is lord of the ascendant in the solar community. He shines with increasing luster every night as he looms grandly above the horizon, appearing on the middle of the month at 7 o'clock, outshining Mars in his decadence, and reigning supreme over the star-lit sky, until Venus rises to bear him company. September is the month preceding his opposition, which occurs on October 12. The month before and the month after culmination include the best conditions for the observation of planets. This is eminently true of Mars, but in the case of Jupiter needs to be modified, for this giant planet is bright as long as he can be seen, shining with a radiant luster that seems never to grow dim. Jupiter will be the starry gem of the September nights, as, rising with majestic grace, he makes his way to the zenith, and slowly descends in the western sky until his light is lost beneath the western hills.

The moon makes a close conjunction with Jupiter on the 9th, at 7 h. 57 m. A. M., being 15′ north. The conjunction is invisible, occurring in the daytime, but moon and planet will be near together on the evening of the 8th, and the celestial exhibition will be passing fair. The conjunction will be an occultation for observers who see the moon in her geocentric position, and who are within the limiting parallels of 56° north and 30° south latitude.

The right ascension of Jupiter on the 1st is 1 h. 32 m., his declination is 8° 0′ north, his diameter is 45″.2, and he is in the constellation Pisces.

Jupiter rises on the 1st at 8 h. 2 m. P. M. On the 30th he rises at 6 h. 12 m. P. M.

SATURN

is evening star until the 25th, and then morning star. He is in conjunction with the sun on the 25th, at 5 h. 25 m. P. M., when he passes from the eastern side of the sun to the western. This, according to astronomical calculation, ranks him as morning star. The law is that planets on the western side of the sun rise before him and are called morning stars, while planets on the eastern side of the sun set after the sun, and are called evening stars.

The moon the day after her change is in conjunction with Saturn, on the 21st, at 3 h. 48 m. A. M., being 1° 1′ north.

The right ascension of Saturn on the 1st is 12 h. 5 m., his declination is 1° 49′ north, his diameter is 15″.0, and he is in the constellation Virgo.

Saturn sets on the 1st at 7 h. 21 m. P. M. On the 30th he rises at 5 h. 32 m. A. M.

MERCURY

is morning star. He reaches his greatest western elongation on the 11th, at 8 h. A. M., when he is 17° 55′ west of the sun, and may be visible to the naked eye under favoring weather conditions.

The right ascension of Mercury on the 1st is 9 h. 59 m., his declination is 9° 46′ north, his diameter is 9″.6, and he is in the constellation Leo.

Mercury rises on the 1st at 4 h. 36 m. A. M. On the 30th he rises at 5 h. 24 m. A. M.

NEPTUNE

is morning star. He is in quadrature with the sun on the 3d, at 5 h. A. M., being 90° west of the sun. His right ascension on the 1st is 4 h. 40 m., his declination is 20° 36′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune rises on the 1st at 10 h. 32 m. P. M. On the 30th he rises at 8 h. 38 m. P. M.

URANUS

is evening star. The moon makes a very close conjunction with Uranus on the 23d. at 8 h. 10 m. P. M., being 5′ south. The moon occults the planet for observers who see her in her geocentric position. Jupiter is occulted under the same conditions. The moon therefore occults four planets, Mars, Jupiter, Saturn, and Uranus, during the month.

The right ascension of Uranus on the 1st is 14 h. 4 m., his declination is 12° 8′ south, his diameter is 3″.5, and he is in the constellation Virgo.

Uranus sets on the 1st at 8 h. 32 m. P. M. On the 30th he sets at 6 h. 41 m. P. M.

Venus, Jupiter, Mercury and Neptune are morning stars or on the sun's western side at the beginning of the month. Mars, Saturn and Uranus are evening stars or on the sun's eastern side.

A New Hybrid Oak.

A glance at the last edition of Gray's "Manual of Botany" will show a list of hybrid oaks, and it will be observed that *Quercus nigra*, the black jack oak, has given rise, as one of the parents, to two forms, and that *Quercus ilicifolia*, the black scrub oak, has given rise to one. Thus *nigra* crosses with the shingle and the willow oaks and *ilicifolia* probably with the scarlet oak. These forms are recognizable, particularly the first two, which have in consequence received names. The fact that *nigra* crosses with *ilicifolia*, however, has not been recorded, but a number of interesting trees of this parentage may be seen on the sandy soil at Watchogue, on Staten Island.

Quercus nigra is plentiful there, and so is *Quercus ilicifolia*, and among these trees, which are easily separated, stand a number of forms that have in part the characters of each. They resemble *nigra* in being erect in growth, in the abruptly tapering branches, and in having the leaves rusty-pubescent beneath. They resemble *ilicifolia* in being small, in their smooth, light-colored bark, and in the retention of their catkins throughout the summer. Occasionally a *Q. nigra* will retain its catkins late into the year, but it is not a usual feature of the tree, as with *ilicifolia*.

These trees vary considerably individually, and are as interesting in this respect as the hybrid oaks reported from Richmond Valley, Staten Island, in the SCIENTIFIC AMERICAN of November 10, 1888. A more extended account is being prepared, but this will serve to give an idea of this interesting hybrid. As it is a recognizable form, I wish to propose for it the name of *Quercus brittoni*, after Dr. N. L. Britton, who was born on the island, and who, with Mr. Arthur Hollick, has done so much in making known its flora.

WILLIAM T. DAVIS.

A Mountain Search Light.

A splendid electrical search light has lately been installed at the little hotel on the summit of Mt. Washington, N. H., and several very interesting experiments have been tried with it recently. By throwing the light toward the sky at an angle of about 45° the reflection was seen in the air above Portland, Me., a distance, air line, of 85 miles; but the angle transversed by the light flashes was 110 miles. Telegraphic messages by means of these flashes were sent from Mt. Washington to the Western Union Office in Portland, and answers returned by wire.

It would be an interesting experiment to locate another flash light of equal power on some elevated point far distant from Mt. Washington, and thus establish flash light communication in both directions. Long distance signaling by sunlight by means of mirrors has been practiced for military purposes. But this requires the signaling stations shall both be in the line of vision. Moreover, the system can only be worked during sunshine. With the electric system it is not necessary the stations shall be in the direct line of vision, as the sky above the objective station receives the illumination.

Precautions Against Cholera.

Official information having been received of an epidemic of cholera in Russia, and in view of the large immigration into the United States from said country, and of the danger that exists of the introduction of cholera into the United States through the medium of personal effects and baggage of said immigrants, it is by the Treasury Department ordered that on and after September 18, 1892, no vessel having on board personal baggage, bedding, clothing, etc., belonging to immigrants from Russia or belonging to immigrants from any cholera-infected district, shall be admitted entry into the United States unless accompanied by a certificate from the consular officer at the port of embarkation to the effect that said personal effects, baggage, etc., have been disinfected in accordance with the methods hereinafter described.

For the disinfection of said articles one or more of the following methods will be used, all articles to be unpacked and freely exposed for disinfection:

1. Boiling in water not less than one hour.
2. Exposure to steam not less than one hour, the steam to be of a temperature not less than 100 degrees Centigrade (212 degrees Fah.), nor greater than 115 degrees Centigrade (239 degrees Fah.), and unmixed with air.
3. Solution of carbolic acid of a 2 per cent strength.

This method (No. 3) may be applied *only* to leather goods, such as trunks, satchels, boots, shoes, to rubber goods, etc., the articles to be saturated with the solution.

ACCORDING to the *Street Railway Review*, there are now nearly 1,000 street railway companies in the United States, of which fully 400 are electrically operated, in whole or in part.

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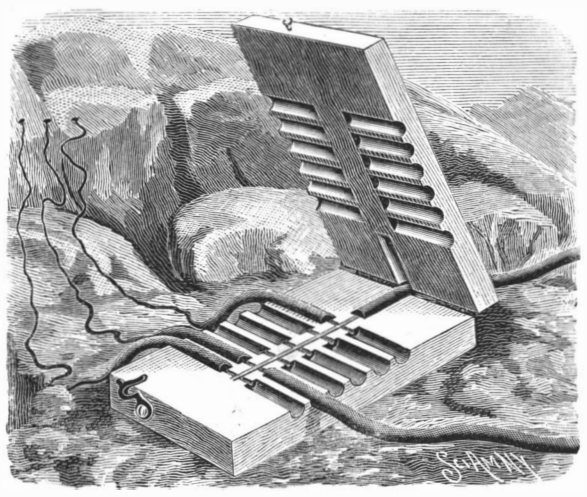
A MULTIPLE FUSE IGNITER.

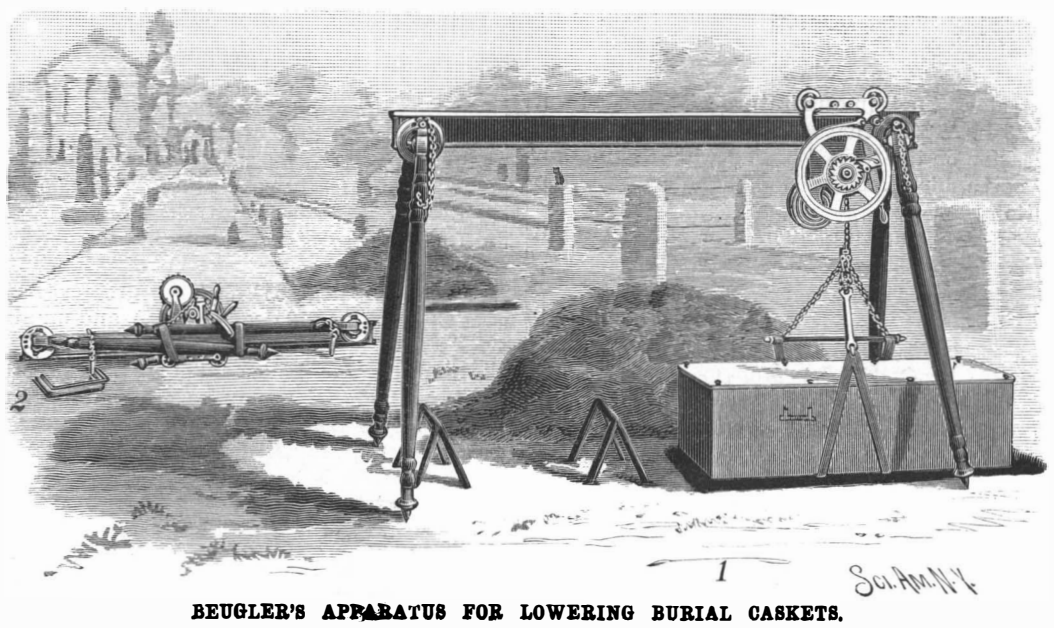
The device shown in the illustration is designed to promote safety in blasting, providing for such purpose a simple and very efficient means of safely holding and simultaneously firing any number of fuses. The improvement has been patented by Mr. William J. C. Doyle, (box 874) of Aspen, Col. It consists of two block-like pieces, hinged together, so as to be folded one upon the other, and firmly secured in such position by a simple form of fastening. On each side of the inner faces of the blocks are short semi-cylindrical grooves, which, when the parts are closed, register and fit closely upon the fuse, and these several grooves are connected by a small branch groove in one of the blocks, this groove being adapted to contain fine powder, by which fire may be communicated to the several fuses. The fuse by which the others are fired may be located in the registering grooves in the hinged end of the block. If desired, ordinary black powder may be mixed damp to form a paste and moulded into the small branch grooves to dry there in position. For wet blasting, the edges of the blocks may be first smeared with cartridge soap, to make a water-tight joint.



DOYLE'S FUSE IGNITER.

A COFFIN-LOWERING APPARATUS.

The accompanying illustration represents an improved apparatus for the use of undertakers, the small view showing the device folded for transport. It has been patented by Mr. John B. Beugler, of Dayton, Tenn. Upon a beam supported by four legs travels a carriage having friction rollers and a lock lever by which the carriage may be locked in a desired position. Near the center of the carriage are depending ears in which is pivoted a grooved pulley in side recesses of which are coiled springs, one end of each spring secured to the wheel hub and the other end to the ears. A chain attached to this wheel passes over a sprocket wheel on a shaft, which also carries a large loosely mounted grooved wheel outside of the carriage, a ratchet wheel on the shaft being engaged by a pawl on the loose wheel, the latter being surrounded by a brake strap and acting as a brake wheel, for which a brake lever is held in convenient position. The lower end of the chain is attached to a bar, to each end of which one end of a strap is secured, the opposite ends of the straps being also connected by a shorter bar. A locking device of novel character is employed, by which the proper adjustment is effected when the casket has been placed upon the straps. This adjustment is readily made with the coffin either at the foot or side of the grave, when, by turning the large wheel, the coffin is sufficiently raised to be readily guided to the proper place in the grave or vault. The operator, by means of the brake lever, has full control of the speed of descent, and should the coffin catch or lodge on any projection, the locking device would not cause its release. When, however, the coffin comes to rest, the chain is slightly slackened, and the locking device then disengages itself, and the chains with the straps constituting the sling are automatically carried upward out of the way, the chain being rewound. The legs being adjustable, the device is designed to operate on a side hill as well as upon level ground.



BEUGLER'S APPARATUS FOR LOWERING BURIAL CASKETS.

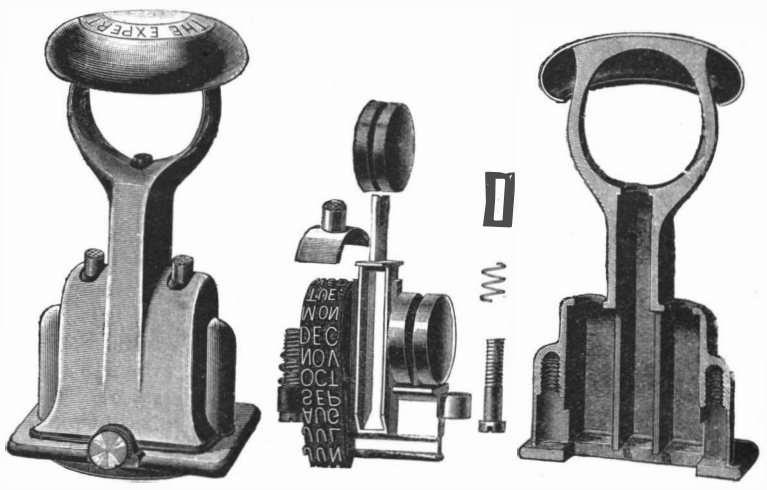
"THE EXPERT" RUBBER BAND DATING STAMP.

The R. H. Smith Manufacturing Company, of Springfield, Mass., who have been for over twenty years leaders in the manufacture of rubber stamp goods and who are the sole owners of the metal-bodied rubber type so widely used, have recently placed on the market a new dating stamp called "The Expert," that has a number of valuable and novel features. The illustrations which we give in this connection show the construction of this stamp very clearly.

The dates and other shiftable printing characters are upon three endless belts, which are mounted to revolve around a central core, the lower end of which forms the backing for the characters while in position to print. From the upper side of this core block rise three standards, the center one for the day belt being highest, as that belt has thirty-one characters and the other two but nineteen each; central on each standard rises a thin blade-like support having a crotched or open bearing at its top end, and upon each of which freely revolves a steel wheel having a central axis. The belts run over these wheels and are shifted by a very novel device which clamps the belt firmly to the wheel, moving both along just the distance from one printing face to another. Between each wheel and the flat shoulder of its standard is interposed an elliptical sheet steel spring, having a slot through it allowing it to pass on over the blade; the lower edge of the wheels resting upon the crowned side of the springs, which, by the tension of the belts, are compressed nearly straight, thereby imparting to each band a gentle tension of about four ounces, and as the belts are so made as to bend only in squares, each square of printing characters is thus effectually held in line while printing—an important advantage never before attained.

The case or shell is cast all in one piece, of hard, white metal, with partitions running through the center, forming a compartment for each band, making it impossible for the bands or their wheels to interfere with each other or become displaced. The core, with its mounted printing belts, slides into the case on substantial guides, and is adjusted to the height of the fixed die by screws passing through ears at each end of the core block, drawing it against a spiral spring in a manner admitting of ready adjustment to the thickest or thinnest die, or even a die thicker at one end than the other.

All of these parts are clearly shown in the accompanying engravings. The finger piece of each shifting clamp projects through a slot in the case. The whole is well made and nickel plated. It will also print the day of the week in connection with any hour of the day, and the side of the stamp on which the year is given has a number of words not found on any other stamp, such as "Received," "Ans'd," "Ent'd," "Paid," "Filed," "Sent," etc. This stamp is an important advance in dating stamps. The manufacturers will be pleased to give additional information to those interested.

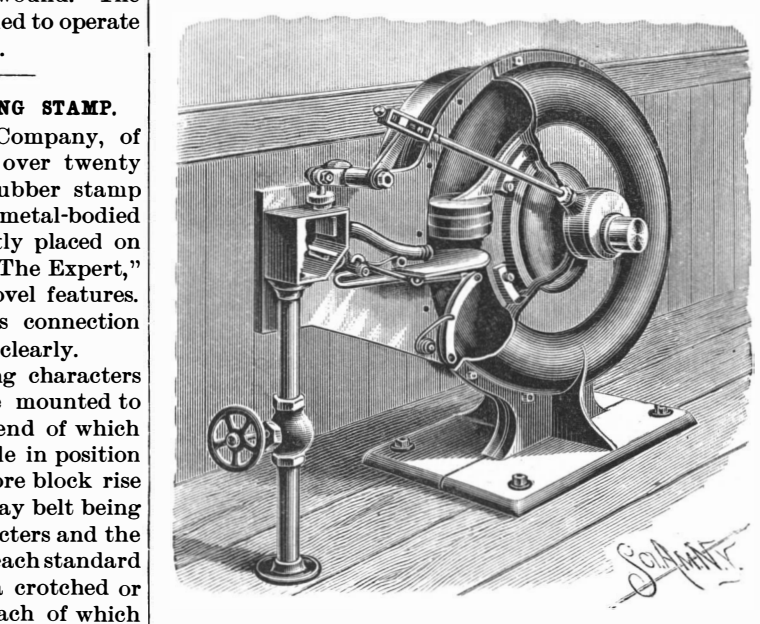


NEW RUBBER BAND DATING STAMP.

EXPERIENCE in electrical welding shows that the metal is strengthened at the point of welding.

AN IMPROVED ROTARY ENGINE.

This improved engine, which has been patented by Mr. Hermann Betten, is designed to utilize the steam or other motive agent to the fullest advantage. The cylinder and its base preferably consist of two parts bolted together, and the piston, secured on the main shaft, has a circular head traveling in the outer circular space of the cylinder. Below the steam inlet pipe a gate is arranged to slide into or out of the cylinder, a spring-pressed arm connected by a link with the gate holding the latter in its inner position, as shown in the illustration, during the most of the revolution of the piston. As the revolution is nearly completed, the piston head strikes the arm, whereby the gate is drawn outward until the head has passed. The gate is also pivotally connected by a link with a valve in the steam chest, so that the steam is shut off during the time the gate is withdrawn as the head is traversing this portion of the cylinder. The steam chest has a transverse partition dividing it into two compartments, one of which is connected with the source of steam supply and the other with the pipe leading to the cylinder. In the latter compartment slides the cut-off valve controlling the amount of steam admitted to the cylinder, this valve being connected with one arm of a bell crank lever, and the other arm of the lever being adjustably connected with an eccentric rod operated from the main driving shaft. This form of engine may be arranged with two cylinders attached to a main driving shaft if desired.



BETTEN'S ROTARY ENGINE.

For further information relative to this improvement address Messrs. Naber & Betten, New Vienna, Iowa.

World's Fair Notes.

A WHALER AT THE FAIR.

The old whaling bark Progress, which has now reached Detroit on her way from New Bedford, Mass., to Chicago, where she and her contents will constitute for the benefit of World's Fair visitors a complete exhibit of the whale-catching industry, has a remarkable history. She has made 17 trips around Cape Horn, all of them successful. Forty times has she crossed the Arctic Ocean in search of the whale and his valuable blubber. In 1869 she set sail and joined the Arctic fleet. In 1871 terrific storms scattered the fleet and all met disaster except the Progress, which came back to New Bedford with 300 sailors, seven captains, five women, and three children, the survivors of the wreck. She carries six whaleboats, which have all seen actual service, and each one is provided with a complete equipment of paraphernalia. These boats are sharp at both ends, and can be driven at great speed by six good oarsmen.

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Plaster of Paris.

The Berlin *Bautechnische Zeitschrift* gives some curious particulars in regard to the use of plaster of Paris. The employment of this material is much less general with us than it is abroad, but there are still many mechanics and artists here who would like to know enough of its properties to handle it to advantage. In the first place, a great deal of plaster of Paris is spoiled in the calcination by the notion that it is necessary to raise it, like quicklime, to a high temperature. The consequence is that the commercial plaster is burned very much at random in kilns, which deliver one portion overburned, and, therefore, inert, a second portion underburned, and also inert, and the rest calcined to the proper degrees, but, if coal is used for burning, often contaminated with sulphide of calcium, and, therefore, unsuited for use. Before delivery, all these qualities are ground up together, the mixture thus depending for its setting quality entirely on the comparatively small percentage of properly burned and pure plaster which it contains. In consequence of this irregularity of the commercial material, sculptors abroad usually prefer to calcine their own plaster. They buy, when they can, powdered gypsum from a deposit known to be granular, rather than stratified, and heat it on a sheet iron plate over a gentle fire to about the temperature of boiling water. If there is good access of air to the mass of gypsum, the heat may be somewhat less than that of boiling water, and it should never much exceed it, or the resulting plaster will be overburned and inert. As the heating of the gypsum powder proceeds, steam, or watery vapor, disengages itself from the mass, at first first freely, and then locally, from little craters, which form themselves for a moment and then disappear. When this phenomenon is observed, the powder should be stirred until the craters cease to form, and a cold piece of glass held over the heap of powder is not dimmed by the vapor. The operation is then complete, and the plaster should be removed from the fire and allowed to cool. So prepared, plaster can be used over and over again. After it has been mixed with water, hardened and used for moulds, it is still plaster, with nothing added but water, which can be driven off by pulverizing and heating the powder exactly as before, when the plaster is recovered in as good condition for use as ever.—*Am. Architect.*

Soldering Metal for Aluminum.

This is the invention of Alexius Rader, of Christiania, Norway. It consists in combining cadmium, zinc and tin mixed in substantially the following proportions, viz.: cadmium, fifty parts; zinc, twenty parts; tin, the remainder. The zinc is first melted in any suitable vessel, then the cadmium is added, and then the tin in pieces. The mass must be well heated, stirred and then poured.

This soldering metal can be used for a variety of different metals, but is especially adapted to aluminum.

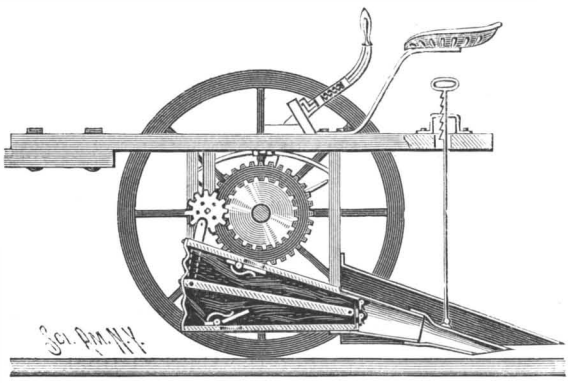
The proportions of the various ingredients may be varied in accordance with the use to which the article is to be put. For instance, where a strong and tenacious soldering is required, a larger proportion of cadmium can be used; where great adhesion is desired, a larger proportion of zinc would be used; and where a nice and durable polish is desired, a greater per cent of tin would be used.

The alloy thus made, independent of its use as a solder for aluminum, is light in weight and capable of taking a high polish.

THAT inebriety is a disease of a physical nature is susceptible of the clearest demonstration, and is generally recognized. There is now no question or doubt of its being hereditary, and no one doubts that it is acquired by social customs. That it is also a disease of the moral nature, engendered by allowing the intellectual faculties to remain inactive, by not exercising the power of conscience and will, by permitting the power of appetite and passions to dominate over conscience, by the lack of a positive character, by defective moral education, and by the want of self-culture, is equally as certain, and can be as clearly proved.—*Dr. Day.*

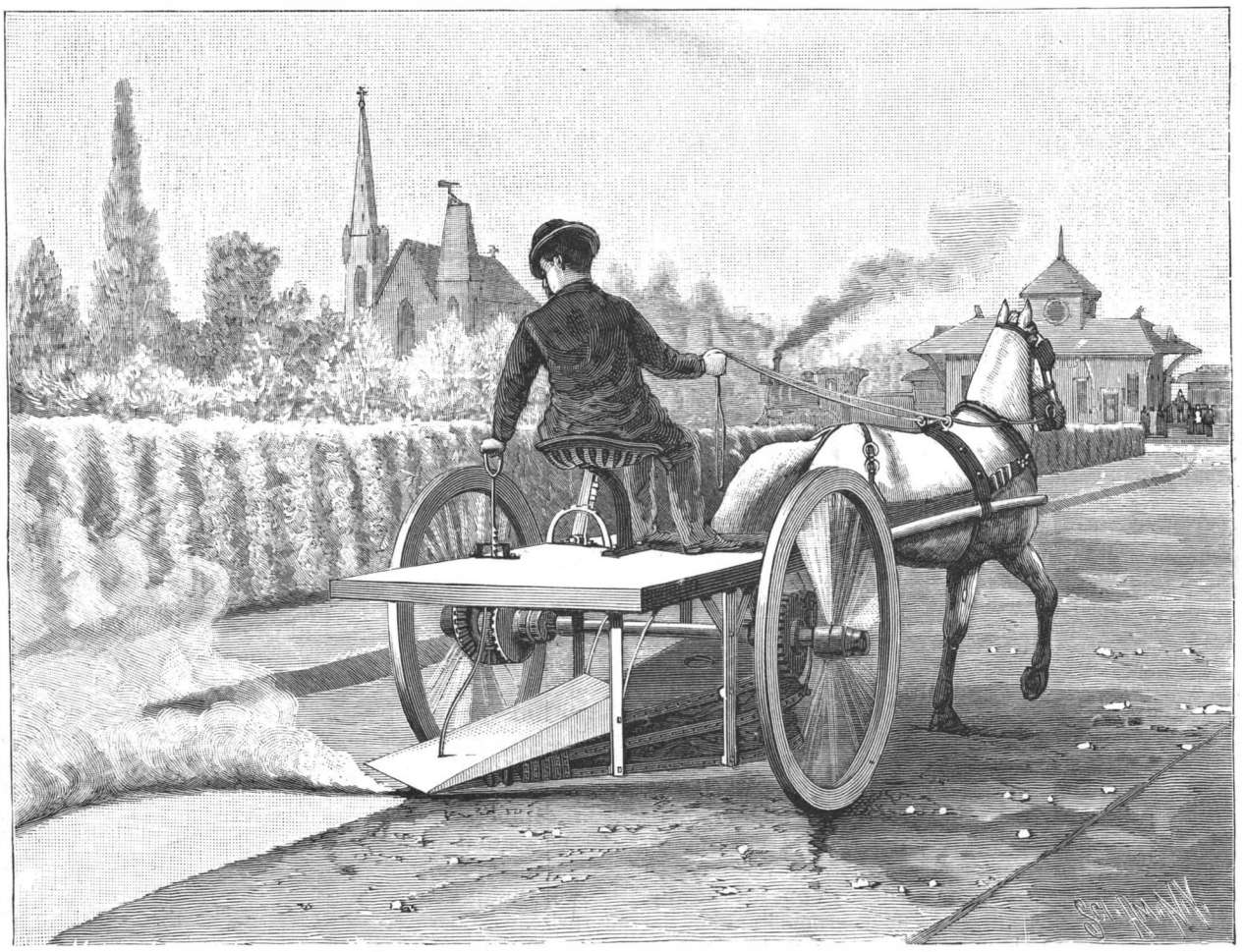
A NOVEL DEVICE FOR BLOWING DUST FROM HIGHWAYS.

"It is as important to remove the worn-out material from a stone road as to put on new material," and "all mud should be brushed from the road surface before applying more stone." These were leading precepts in the mind of John Loudon Macadam, the



ROAD CLEANER—SECTIONAL VIEW.

Scottish engineer whose name has for half a century been connected with the excellent road-making system he introduced, and which now everywhere bears his name. Road making, after his system, was practically commenced in England in 1816, and within eight years from that time over twenty thousand miles of the public roads of Great Britain were macadamized. The proper cross section and grading being established, with adequate provision for thorough drainage at all times, the Macadam system primarily consists of laying small angular broken stones directly upon the earth, a yielding bed being preferred to a rigid foundation, and the angular shape of the stones causing them to bind together to a greater or less extent, as they are fixed in their places first by the roller, and afterward by the traffic upon the road. The number of courses and their thickness and the different sizes and kinds of stone will, of course, vary with the location and circumstances and the amount to be expended on any given length of roadway, but the precepts above quoted, as to the removal of dust and loose material from the surface, apply in all cases where a good and permanent roadbed is to be maintained.



J. J. ASTOR'S PNEUMATIC ROAD-CLEANING MACHINE

The pnematic 'road-cleaning machine shown in the accompanying illustration, which has been invented by Mr. John Jacob Astor, of New York City, and a model of which is in use on his place at Ferncliff, Rhinebeck, N. Y., is especially designed to facilitate the thorough, rapid, and inexpensive removal of this worn-out material, or detritus, from the roadbed, either blowing it into the bushes or over the adjacent fences at the side of the road, or laying it in windrows, whence it may be conveniently removed, as may be desired by the operator of the machine. This feature of the machine adapts it for use for efficiently cleaning streets in country towns as well as for work on the public roads beyond such limits.

Upon the inner face of one of the two traction wheels, loosely mounted on the axle of the machine, is a bevel gear meshing with a bevel pinion supported by a bracket, the pinion meshing with a bevel gear splined upon and having a slight longitudinal movement along the axle. The latter gear is moved by a hand lever extending upward through the platform, and having a thumb latch for engagement with a rack or other keeper, the arrangement being such that, according to the adjustment of the hand lever, the axle will or will not be rotated, as may be desired, by the revolution of the traction wheels as the machine is drawn along. A double-acting bellows, supported in a diagonal position under the platform, affords a continuous blast of air when the machine is in operation, the top and bottom plates of the bellows being rigidly attached to the supports, and a central pivoted partition having an up and down movement communicated from a gear mounted on the axle. An adjustable connection, through a pinion, affords means of giving more or less throw to the central pivoted partition of the bellows, or other gearing may be employed to increase the power of the bellows, the force of the air blast being readily adjustable for the purpose of placing the dust in windrows at one side or blowing it to a distance from the road. The bellows has a supplemental nozzle, adjustable vertically and laterally, the distance at which this nozzle is supported above the ground being conveniently regulated by a hand lever within easy reach of the driver. To keep the dust from flying upward, a hood covers both the nozzle proper and the auxiliary nozzle.

It will be seen that, by means of this machine, an air blast of almost any desired force may be obtained, and that it can be readily directed by the driver in such way as to be most efficient in completely clearing the roadbed of dust or any light or loose foreign matter. The great advantage this machine has over brushes is that there is nothing in the air blast to wear out or to remove the solid part of the roadbed.

The subject of road making has come into a good deal of prominence during the past few months, largely from the efforts of a few public-spirited individuals, who have taken pains to point out, in a most conspicuous manner, the generally wretched character of our roads. Road making has been too much neglected since the railway age set in, and the farmer and country people generally are paying dearly for such neglect. In the making of new roads, using broken stone, and rolling, as is most common, there has lately been started a healthy movement, but it will be years before we shall see such an improvement as is most urgently to be desired. It has been more for the sake of aiding such efforts than for any other reason that this inventor has given his attention to the subject, and has constructed the practical and efficient machine shown in the illustration.

The Velocity of a Cannon Ball.

The first firing was done on the new proving grounds of the Bethlehem Iron Works on the 28th of July. Screens were arranged in connection with electrical instruments for measuring the velocity with which the shots traveled. In the test made, the object was to obtain the velocity of a 250 pound shot fired from an 8 inch gun with a charge of 81 pounds of hexagonal prismatic powder. The standard set down for these conditions is 1,700 feet per second, or at the rate of about 1,200 miles per hour. The instruments showed a velocity of 1,702 feet for the first shot fired; this came so close to the standard that further tests were considered unnecessary. This is said to be one of the most satisfactory tests made in the history of modern ordnance.

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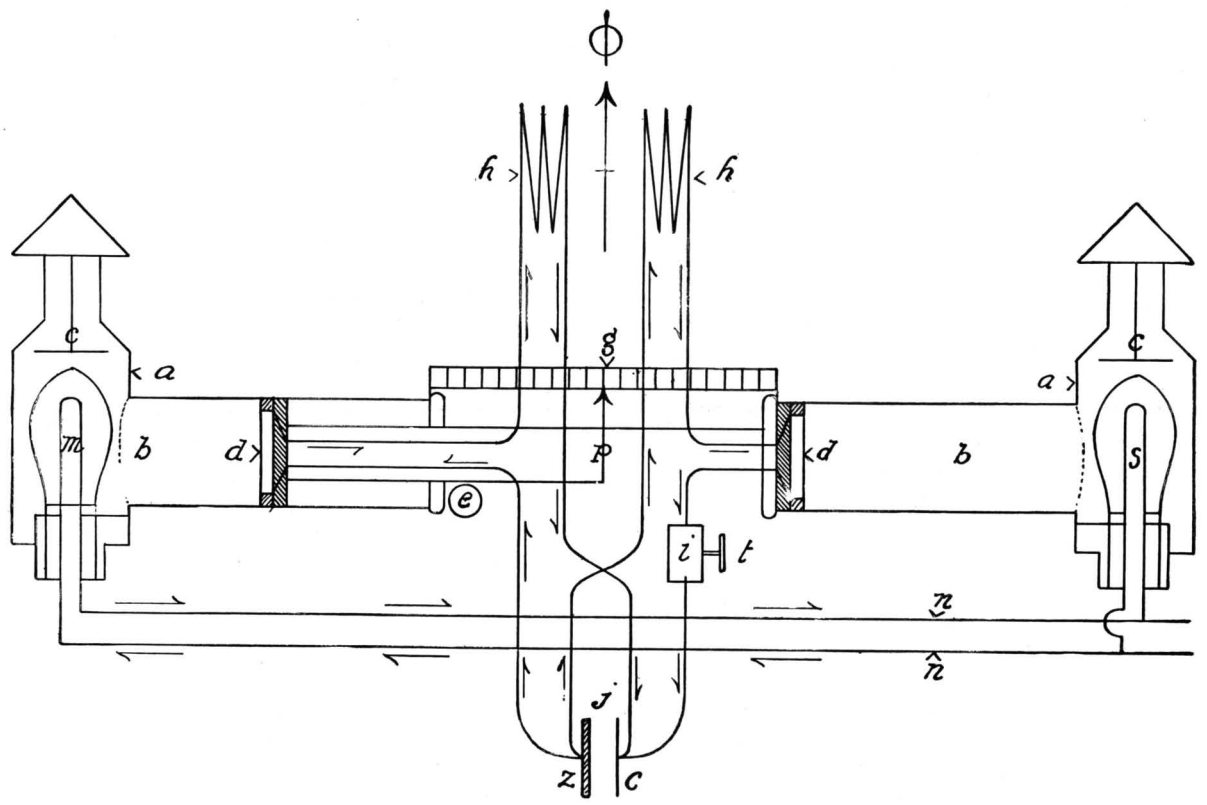
A NEW PHOTOMETER.

On account of the difficulty of eliminating the personal equation, photometric work has always been attended with a great deal of uncertainty, and an instrument for the measurement of light, whose accuracy does not depend upon the sense of sight, has long been needed, but since the days of gas lighting, and more especially of electric lighting, a reliable instrument has become an absolute necessity. Various ways have been suggested for avoiding the uncertainty of the ordinary photometric methods, but the best device for the purpose that has come to our notice is the invention of Mr. S. F. Van Choate, of Boston, which he has given to the world without price or the expectation of reward.

In this instrument—which is shown in the annexed diagram—a selenium cell is employed to receive the light beam, and to thus vary the electric current which is made use of to give the visual indications. The instrument is in the nature of a balance connected with a differential galvanometer, the standard light being arranged to affect one side of the balance, and the light of unknown strength being placed upon the opposite side of the instrument. The tubes, *b*, of two lanterns, *a*, are preferably arranged axially in line. In the right hand lantern is placed the light, *s*, to be tested, above which is suspended a disk, *c*, for preventing the escape of light. In the other lantern is placed the standard lamp, *m*, and in the tube, *b*, upon the same side of the apparatus is fixed an adjustable selenium cell, *d*, which is moved along the length of the tube, *b*, by the pinion, *e*. To the selenium cell, *d*, is attached an index, *p*, which slides in front of the scale, *g*. If the standard lamp and the lamp to be tested are electric lamps, they are connected up in an electric circuit in the usual way.



VAN CHOATE'S ELECTRIC PHOTOMETER.

In the upper portion of the diagram is shown a differential galvanometer which is connected with a battery, *j*. The right hand coil of the differential galvanometer is connected by one of its terminals with the zinc plate, *z*, of the battery, while the remaining terminal of the coil is connected with the selenium cell, *d*, which in turn is connected through the rheostat, *i*, with the carbon plates, *c*, of the battery. In a similar manner one terminal of the left hand coil of the galvanometer is connected with the carbon plate, *c*, and the remaining terminal is connected with the adjustable selenium cell, *d*, from which a wire extends to the zinc plate, *z*, of the battery. The two branches of the battery circuit are placed in electrical balance by means of the rheostat, *i*. The selenium cells, *d*, being alike, if the lamps, *s*, *m*, are equal, the distance between the selenium cells, *d*, and their respective lamps will be the same. If, however, the lamp to be tested is inferior to the standard lamp, the selenium cell, *d*, which faces the standard lamp, will be moved until the galvanometer indicates equilibrium. The difference in the distance between the selenium cells and the lamps, as indicated on the scale, will give the basis for the calculation of the relative intensities of the light from the two lamps, calculations being made according to the law of inverse squares.

This instrument can be used in measuring the intensity of light from other sources by simply adapting the lanterns to the kind of light used for standard and for testing.

Casson's Steel Process.

In the manufacture of steel and ingot iron some attention is just now being paid to Casson's new process, as carried on at his extensive works in Staffordshire, England, the purpose in view being to so carburize the molten metal that the amount of carbon resulting may be more or less accurately determined. This is accomplished by introducing carbon, in the form of charcoal, into the casting ladle, and then tapping the metal direct from the converter or furnace into the ladle, after adding any desired quantity of ferro-manganese or other material; in this way, as is found, a high percentage of carbon can be readily introduced into the metal, and a high grade of steel produced. In practice, that is, to produce a high grade of steel capable of standing from 26 to 34 tons tensile strain, the use is called for of about 5 lb. of finely ground charcoal per ton of metal, the usual percentage of ferro-manganese being also somewhat increased. Other forms of carbon than wood charcoal may also, it is stated, be employed, so long as they do not contain such a high percentage of sulphur or other ingredients as would be injurious to the resultant steel.

The Great Chicago-Mississippi Waterway.

Chicago has surprised the world in many wonderful undertakings of late, and not least among them is the proposed waterway from that city to the Mississippi River, upon which contracts for one section, involving $10,696,755, were let a short time ago. In letting these contracts the drainage board in charge of the great sewer, as it is now commonly called, has shown considerable boldness. As it is claimed that this waterway will serve the twofold purpose of diluting Chicago sewage and for future commerce between the lakes and the Mississippi, some details regarding the plans upon which work has been begun will probably be of interest at this time. The canal will have a width at bottom of 160 feet and a uniform depth of 19 feet, a gradient of 5 inches to the mile, and a capacity of 600,000 cubic feet per minute. The Suez canal has a bottom width of 72 feet, just sufficient for one large steamer. It is, in fact, a "single track" canal with turn-outs; the Chicago canal will be "double track." The Suez canal has a top width of 197 feet, the depth in center being 26 feet, or 7 feet more than that of the Chicago canal. The superior dimensions of the Chicago canal were not so much demanded in the interests of navigation as in that of sewage disposal, the law demanding as it does a water supply for diluting Chicago's present and future excreta to the enormous amount of 600,000 cubic feet per minute. The position of the present work is neither the beginning nor the end of the programme of the sanitary commission. It is a stretch of 14 miles of heavy cutting across what is called the Chicago divide, or "height of land." It commences at a village called Willow Springs, 20 miles from Chicago Court House, close to the present Illinois and Michigan canal, and runs in a southwesterly direction to Lockport, a town three miles from Joliet. The total length of cutting will be 14 miles, the maximum depth in rock about 35 feet, and in clay about the same.

Difficulties to be met with in this project are, of course, very numerous. It will involve a most prodigious expenditure, and notwithstanding the claims of its promoters that it is intended as a highway of commerce, all attempts to secure appropriations from the general government will be stubbornly fought. The local government engineer, Captain Marshall, has already opposed the application of Chicago for government grants in aid of the enterprise, considering as he does that to do so would be to apply federal money to municipal purposes. Careful study has shown that no positive detriment would result to lake shipping on account of the abstraction of so large an amount of water from Lake Michigan, but the great cost of securing an entrance to the city of Chicago and the lake, and the effect of such entrance on the transportation problem, are all-important questions. The present harbor entrance, narrow and with low banks, has been a barrier to rapid transit on account of the swing bridges, which obstruct also the navigation. The programme of the sanitary board includes the entire filling up of this present harbor entrance, the creation of industrial properties on its site, and the facilitation of rapid transit across the new cuts by means of tunnels. Seeing that every street must have its tunnel, which will have to be about 1,500 feet long, including approaches, in order to make one crossing of the same capacity as a present street, the cost will be about $1,500 per lineal foot, or $2,250,000 per street. This work alone would run into a big sum of money, and it is evident on every hand that in the matter of sewage disposal Chicago has an important subject to deal with.—*Marine Review.*

The Discouragement of Industry.

Judging from the inflammatory editorials, personal attacks, and sensational reports in certain public journals, one of the last things that a man ought to aim at in this land is success and eminence in his business, especially if it be one requiring the investment of a large amount of capital and the employment of a large number of operatives.

Men of large means in such positions at once become the target for sensational journals, who offer absurd suggestions, assail them with personal abuse, or attack them as "robber barons," "purse-proud millionaires," "aristocrats," and the like. Yet these very men have built up great industries, increased the wealth of the community, given employment to thousands, and been liberal in their charities and public gifts.

All that they have done, however, in this direction is forgotten, because while benefiting others they have enriched themselves. They have sinned in being successful, while others with less talent, genius, and brains have failed or plodded on in hopeless mediocrity.

One of the worst features of the disturbance at Homestead has been the pandering to a morbid desire to assail capital, because it is capital, by the sensational press. Indeed, we may say this is not the chief reason; it is well known that the popular side of a question is with the laboring class. There are many employed by one employer. Hence the publishers, seeing a profit in increased daily sales of paper, throw right and principle to the winds, print the most absurd statements to please the excited mass, and do not hesitate to attack in the vilest and most outrageous manner men who have by their exertions added to the wealth of the country and increased its industrial capital and facilities.

Andrew Carnegie, who has created by his active brain a business which employs four or five thousand men, who has given away for the public good gifts to the amount of hundreds of thousands of dollars, has a difference with some 300 out of the 5,000 men with regard to what he considers the value of their services. That value is not to be gauged by the amount of money he is worth, but by the market price of labor. Mr. Carnegie gets no more than the market price for his iron, and if he is to pay more than proper cost of production in wages, he must stop his works, throw thousands of men out of employment, and live on the income of his savings.

If the workman refuses to accept, of course Mr. Carnegie must do the best he can to supply his place at the rate he offers, and one has a perfect right to do so throughout the civilized world. Yet while this question is in abeyance and he is striving to protect his property from illegal occupation and injury, he is held up as a tyrant and an oppressor of the poor, is depicted in public journals as stabbing the workingman with a bloody knife on one hand and giving money to foreign charities on the other.—*Com. Bulletin.*

Tools of the Pyramid Builders.

A two years' study at Gizeh has convinced Mr. Flinders Petrie that the Egyptian stone workers of 4,000 years ago had a surprising acquaintance with what have been considered modern tools. Among the many tools used by the pyramid builders were both solid and tubular drills and straight and circular saws. The drills, like those of to-day, were set with jewels (probably corundum, as the diamond was very scarce), and even lathe tools had such cutting edges. So remarkable was the quality of the tubular drills and the skill of the workmen that the cutting marks in hard granite give no indication of wear of the tool, while a cut of a tenth of an inch was made in the hardest rock at each revolution, and a hole through both the hardest and softest material was bored perfectly smooth and uniform throughout. Of the material and method of making the tools nothing is known.

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HIGH-SERVICE WATER TOWER, BROOKLYN.

(*Continued from first page.*)

feet above the street level, the tower extending 58 feet above the top of the tank or water reservoir it contains. The manner in which the reservoir is supported in the tower is shown by the sectional view on this page. The height of the tank is 75 feet, with an inside diameter of 16 feet. It is built up of fifteen rings of boiler iron of varying thickness, the two rings nearest the bottom being half an inch thick, the two next above $\frac{7}{16}$ of an inch, then three rings of $\frac{3}{8}$ of an inch each, three of $\frac{5}{16}$, and five of $\frac{1}{4}$ of a inch each. The iron is of a high grade, and has a tensile strength of 52,000 to 55,000 pounds. The tank is supported upon a flooring of steel girders resting upon masonry piers, the bottom of the tank being 34 feet 7 inches above the foundation.

The flow of water to and from the tank is indicated by the arrows, and the inlet and outlet pipes are each 20 inches in diameter. A short section of pipe connects these pipes, so that water may be pumped directly into the service main without being passed into the reservoir if desired. Within the reservoir is arranged an overflow pipe, adapted to discharge into the old reservoir. The top of the overflow pipe is 12 inches below the top of the reservoir, and in it are arranged four reducing disks or diaphragms, to break the force of the fall of the water in the pipe. The pipe is 10 inches in diameter, and the reducing disks have each a central opening of 6 inches. Fig. 2 shows one of these disks in position, Figs. 2, 3 and 4 also showing the manner of supporting and holding the overflow pipe in place. A spiral staircase, 2 feet 10 inches wide, leads around the tank to an outlook room above, in the top portion of the tower, from which a view of wide extent is afforded.

The pumping plant is to consist of two Davidson high-service pumps, each capable of pumping one and a half million gallons a day. It is expected that the entire cost of this improvement will be about $100,000.

The beautiful memorial arch which forms so prominent a feature of the picture is now very near completion. It has been erected by the city "To the Defenders of the Union, 1861–1865," as indicated by an inscription upon an entablature below the frieze, and is built of light granite. It is 80 feet long, 71 feet high, and 45 feet wide. The top will be reached by stairs in each abutment.

Locomotive Performances.

Almost every one is familiar with the remarkable run recently made by a Schenectady locomotive hauling a special train on the New York Central Railroad, when the distance of 439½ miles from New York to Buffalo was made at an average speed of nearly 60 miles per hour, and which was the precursor of the Empire State express, which makes the regular run at an average speed of over 52 miles per hour.

More recently we have accounts of an interesting record made by a well known writer on two runs between New York and Albany, on which a large number of indicator cards were taken. The weight of the train was about 270 tons. The steam pressure varied from 160 to 170 pounds. From an inspection of about a dozen cards, the indicated horse power varied from 551 horse power at 44 miles to 1,120 horse power at 78·9 miles. At 60 miles per hour the train resistance is stated to have been 15 pounds per ton and at 70 miles 17·10 pounds per ton. About seven pounds of water were evaporated per pound of coal.

A remarkable statement concerning this performance was made by Mr. Sinclair, which, while almost incredible, will, if borne out by an analysis of facts, prove to be something of a surprise to those who make their prophecies of the electric economies by comparative statements.

In the description of these tests it is stated that the whole trip shows an indicated horse power per hour for an average expenditure of only about 3⅛ pounds of coal per hour. This is far better than many stationary engines.

On the New Jersey Central road one schedule time is 86¼ miles in 89 minutes, which is made where there are a number of necessary slackings. On May 13 the time was taken of the speed of a Baldwin compound locomotive for a considerable period of time on one of the regular runs. Ten continuous miles were made in 452½ seconds, and five were made in 222 seconds. The fastest time taken was 44 seconds and the slowest noted was 47.

On February 26 a similar compound passenger locomotive running on the same road broke all steam records by running a mile in 39¼ seconds, or at the rate of nearly 92 miles per hour.

At this speed the indicator cards showed 930 horse power, and the drivers, which are 78 inches in diameter, were making 395 revolutions per minute.

In making these very high-speed runs there is not much attempt at maximum economy of coal consumption, the necessity being to generate steam as fast as required by the cylinder, but, on taking an average of five trips, I find that there was evaporated 7·19 pounds of water per pound of coal used and 9·41 pounds of water evaporated per pound of coal consumed. The total weight of the train varied from 213 to 241 tons.

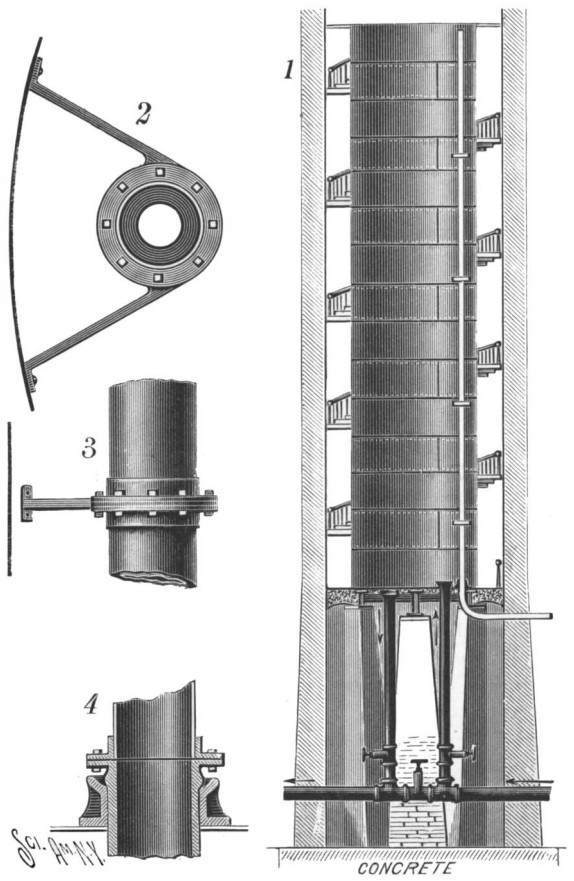
Some time ago I made a very careful analysis of the work done in the elevated roads in New York City, with a view of determining the coal consumption and the duty performed by the locomotives. At the time this investigation was made, now nearly seven years ago, there were in use on the Third Avenue division 63 trains at one time, running at very close intervals. The weight of the train was from 80 to 90 tons; the speed was often as high as 20 to 25 miles an hour; stops were made every third of a mile; in short, the duty demanded of the engines was exceedingly severe.

The maximum indicated horse power of the locomotives was found to average about 163 horse power, although on occasions these locomotives have been worked up to 185 horse power. Work was divided approximately as follows:

Acceleration in starting, 59 per cent; lifting, 24·3 per cent; and traction, 16·7 per cent. The average horse power exerted was 70·3 horse power, considerably less than one-half of the maximum.

The work on the line was so distributed that there was an almost constant total duty of about 4,500 horse power. The locomotives were on duty twenty hours, but used steam only six hours, and including all losses when standing still and the amount of steam used in braking, there was a horse power developed for about 6·2 pounds of coal per hour.

I believe that these figures are entirely reliable, and they show a remarkable performance when we consider the class of duty.



HIGH-SERVICE WATER TOWER—SECTION.

There are, generally speaking, three distinct elements constituting the resistance of train movement on a level, and they have a most important bearing when we consider the operation of long or short trains, and at high speeds. One of these elements is the friction of the train in its bearings; with good rolling stock this is about 8 pounds per ton. For all reasonable speeds it is probably fairly constant, provided the lubrication is good. Another element is that of air resistance, which varies with the shape of the forward end of the train, the condition of the air, the direction of the wind, and the velocity of movement. The third I may call the train-lifting or rail-bending effort, which depends upon the weight and swiftness of the train and solidity of the roadbed.

Dr. Dudley stated that on the New York Central system he found that trains of about 250 tons, when running at a speed of a mile a minute, had a resistance of from 10 to 12 pounds per ton, but that on short trains of two or three cars the resistance sometimes ran as high as 35 or 40 pounds per ton.

This is probably due not to any change in the friction of the bearings, but to the fact that the air resistance enters as a much higher component of the total.

It at once emphasizes the fact that the operation of short trains at high speeds must, no matter how good the track or how favorable all other circumstances, be with a train resistance higher than required by long and well-vestibuled trains.

Mr. Dudley further stated, in speaking of the influence of stiff rails, that the difference in power required on the Chicago Limited when running on an 80 and a 65 pound rail was from 75 to 100 horse power per mile, that is, somewhere between 10 to 12 per cent of the power actually developed, and he estimates that with a 105 pound rail, which is nearly twice as stiff as the 80 pound rail, there would probably be saved another hundred horse power per mile, making a total saving of a quarter by less than doubling the weight of the rail. In his opinion it is perfectly safe to run a steam engine 120 miles an hour on this heavy rail.

Almost all the locomotive work of the United States has been done up to the present with simple engines. Their weight and capacity has been increased, their steam pressure raised until the standard is now about 140 pounds. Within recent years, however, the compound locomotive has come into use, and there is a comparatively large number of them in daily service. The steam pressure has gone up to 180 pounds as a standard, working sometimes as high as 200 pounds, but these are by no means the limits of steam pressure.

On the Paris, Lyons, and Mediterranean Railway the standard for steam pressure for compound locomotives is 250 pounds. The compound locomotive has still its battle to fight, but I think he would be a rash man who would say that the days of still higher steam pressure are not to come and that the triple expansion locomotive will never exist.—*Frank J. Sprague.*

Paving Estimates.

Estimates per square yard for the different kinds of paving for Pacific Avenue, in Tacoma, are as follows:

WOOD.

Size of blocks, nine inches long, three inches wide and six inches deep. If concrete is used for foundation it would be six inches thick, and in the proportion of one part of cement to four parts of sand and six parts broken rock. Estimate for one square yard of wood blocks:

Concrete, six inches thick, at $9 per cubic yard	$1.50
Sand, one inch thick, at $1 per cubic yard	3
Six inch block, fifty-four feet B. M., at $10 per M	54
Labor, 2 cents per square foot	18
Total cost	$2.25

BRICK ON CONCRETE, PER SQUARE YARD.

Concrete, six inches thick, at $9 per cubic yard	$1.50
Sand, one inch thick, at $1	3
Brick on edge (8x5x4), eighty-one brick per square yard, at $14	1.13
Labor, 2 cents per square foot	18
Total cost	$2.84

DOUBLE BRICK PAVEMENT, PER SQUARE YARD.

Gravel, eight inches thick, at $1 per cubic yard	$0.22
Brick, laid flat, forty-one brick, at $14	57
Sand, two inches thick, at $1 per cubic yard	6
Brick on edge, eighty-one brick, at $14	1.13
Labor, per square yard	25
Total cost	$2.23

BITUMINOUS ROCK.

Concrete	$1.54
Bitumen laid in place	1.20
Total cost	$2.74

Florida Moss.

The valuable moss of Florida, says Mr. Harry Bomford, abounds in the hammocks and back lands. It is gathered chiefly by negroes. In its natural state it hangs in festoons from the limbs of trees in strands from one to five feet in length. The moss is gathered by pulling it from the trees with long poles, or by cutting the trees down and then removing it. The moss is buried in the earth for about a month, after which it is dug up and is dried and shaken and sold to the local moss dealers for $1 per hundred pounds. It is then run through a machine called a gin, which is nothing more than a cylinder covered with three-inch spikes revolving between a roll of similar stationary spikes. The action of these spikes is to knock out some of the dirt and trash, but it does not complete the job. It is then shaken over a rack formed of parallel bars, after which it is pressed into bales of about 200 pounds each. Some of the moss mills do all this work by hand, except the ginning. The moss, after having gone through the above process, brings from $2.50 to $3 per hundred pounds.

If, instead of allowing it to remain in the earth for one month, it is left there for three months, the entire bark of the moss is pulled off and there remains a beautiful black fiber almost exactly like hair. The hair moss brings from $5 to $7 per hundred pounds.

Mr. Bomford suggests the treatment of this moss as a good field for invention. He thinks a machine could be made which would take off the bark, leaving the fiber, without the necessity of burying the moss for so long a time in the earth.

Universal Cement.

250·0 sugar placed in a flask are dissolved in 750·0 water by aid of a water bath, 65·0 slaked lime added and the mixture warmed for three days at 70–75° C., agitating repeatedly. After cooling, the supernatant liquid is poured off clear; 200·0 are diluted with 200·0 water and 550·0 finest glue allowed to swell in it for three hours, when it is heated until perfect solution takes place; after restoring the original weight by adding water, 50·0 acetic acid (96 per cent) and 1·0 pure carbolic acid finish the preparation.

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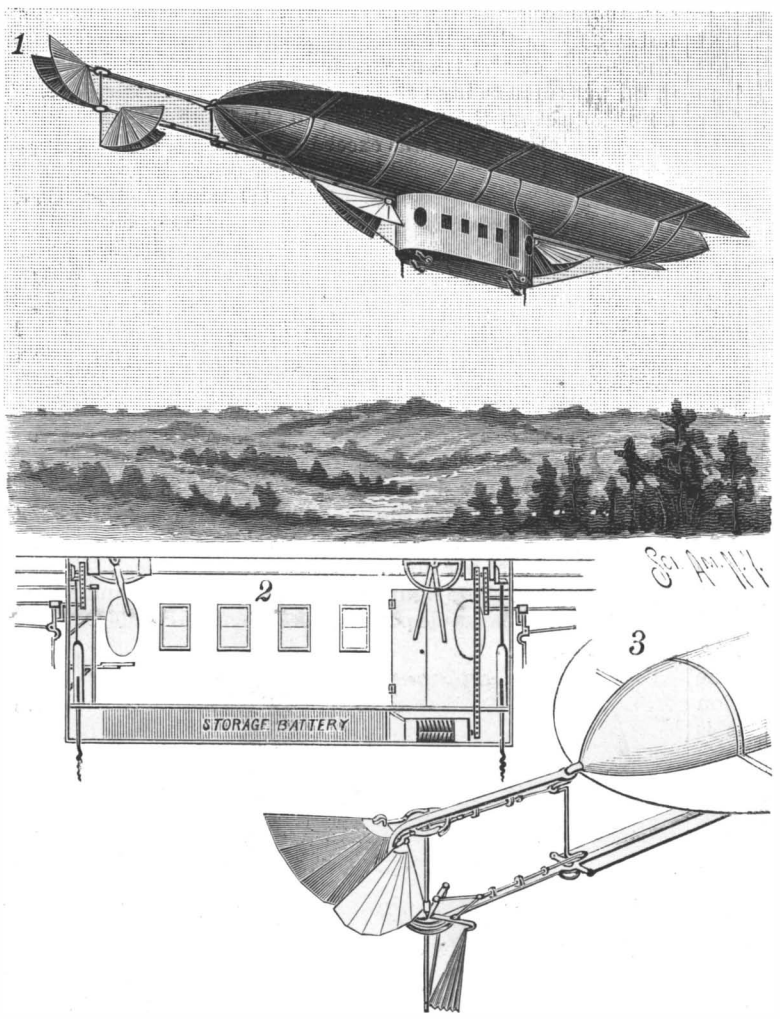
AN IMPROVED AIR SHIP.

An air ship designed to have large carrying capacity, to be strong and yet light in construction, and be susceptible of easy and perfect control, is shown in the accompanying illustration. It has been patented by Mr. B. F. Barnes, of Circleville, Ohio. The balloon portion is of elongated cylindrical shape, and the cab is suspended therefrom by rods extended from the frame of aluminum bands encircling the balloon, the frame of the car also consisting of aluminum rods covered by oil cloth, in which are windows and doors. On the underside of the car, as shown in Fig. 2, is a storage battery compartment and an electro-motor, the latter adapted to operate a main shaft running parallel with the balloon. The raising and lowering wings are arranged in pairs at the front and rear ends of the car, these wings being operated from the main shaft, as are also two sets of propelling wheels mounted on a frame at the front of the machine, as shown in Fig 3, the frame being capable of lateral swing, through a mechanism connected with a lever in the car, to facilitate the steering or guiding of the ship. Both sets of these wings vibrate on a single vertical rod, the crank shaft at its lower end carrying a bevel gear which meshes with a bevel gear on the front end of the main shaft. The lifting and lowering wings at the ends of the car are designed to be inoperative when the propelling wings are working, and the main shaft, which operates both, is accordingly arranged to be longitudinally movable, to effect the engagement or separation of bevel gears. To aid the flotation of the apparatus, horizontal extensions are arranged opposite each other upon the balloon, and rigidly supported therefrom by a suitable framework, and to the rear end of each extension is pivoted a horizontal rudder, capable of being moved vertically, the rudders being connected to operating levers in the car. At each end of the car is an auger, to be screwed into the ground to anchor the ship, and springs, carrying rollers at their ends, are extended like feet from the bottom to lessen the shocks or jar on the descent of the car to the earth.



BARNES' AIR SHIP

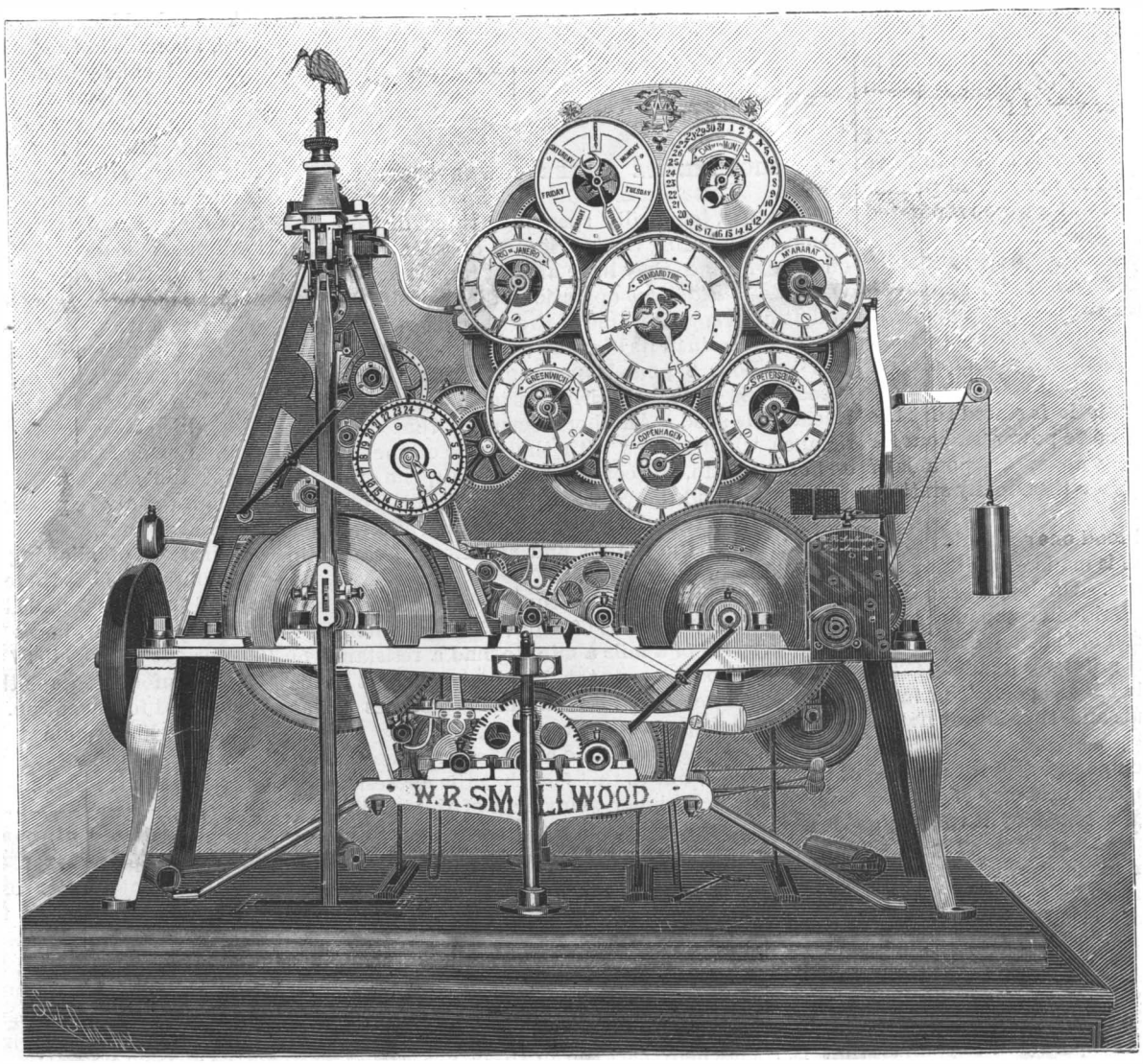
NOTABLE SKILL IN CLOCK MAKING.

The clock shown in the accompanying illustration, made by Mr. W. R. Smallwood, of Gowanda, N. Y., required two years for its construction, and was finished September 1, 1885. It gives, in addition to standard local time in both the 12 and 24 hour systems, the day of the month and that of the week, and the true sun time at many important points on the earth's surface. Its dimensions are, length 34 inches, height 32 inches, and depth 13½ inches. The movement alone weighs 165 pounds, and is run by three weights aggregating 256 pounds—only half the weight usually required, as a double cord is used. The material used in its construction was principally brass, although some Norway iron, cast iron and steel were employed. The parts are nearly all plated with nickel, gold and silver. The gear wheels all told carry over 5,000 teeth, the largest being 9 1-10 inches in diameter and having 180 teeth, while the smallest has only a single tooth, and measures ¼ inch in diameter. The steel cables which carry the weights are 3-16ths of an inch in diameter, and each is 24 feet in length. The pendulum, of red cedar, is 57 inches long and oscillates 54 times per minute, bearing a 6 pound adjustable iron ball.

Three distinct trains are included in the works—the main strike, the quarter strike, and the running train, the latter provided with a pin escapement. The striking trains are composed of four bells and a large gong. One bell sounds the quarter, two the half, three the three-quarters, and four the full hour, the latter being immediately followed by the gong. It also has a cuckoo attachment, giving a melodious tone with the main strike.

In addition to standard local time and the day of the month and of the week, the true sun time of the following places is given by its sixteen dials: Rio de Janeiro, Greenwich, Copenhagen, St. Petersburg, Mt. Ararat, Calcutta, Pekin, Melbourne, Sandwich Islands, San Francisco, Denver, and St. Louis, and these several dials can be set simultaneously by turning a single wheel. Connected with the running train is a retaining power to maintain its motion while winding. The arm of the main strike fly is of cut brass 2 feet long, and has polished cedar cams. The main running and strike wheels are 9 1-10 inches in diameter, ⅝ thickness, and are each provided with 180 teeth of 20 pitch. Brown & Sharp's cutters were used in cutting all the gear wheels, with the pinions, 115 in number. The weights fall about 8 feet in 7 days. To prevent dust from entering the oil holes, the main boxes or bearings are provided with imitation oil cups. All the pinions in the three trains are made from casehardened Norway iron. The main barrels are 4¼ inches long inside of the ratchets and rims and 4 inches in diameter. The movement is covered with a glass case, so that every portion of the working parts is plainly visible, and the whole work is beautifully finished.

The attachment to the extreme right, with small weight, is an automatic fire alarm test, a special contrivance of Mr. Smallwood, who is the superintendent of the Gowanda fire alarm system. It is attached to the main strike and connected to the public fire alarm system, and every day at 12 o'clock the movement is released and all the fire alarm signals are rung five times as a test that all is well. It is proposed to exhibit this clock at the coming Columbian Exhibition. Those who are interested to obtain further particulars in relation to it may address the maker, at Gowanda, N. Y.



SMALLWOOD'S EIGHT-DAY SIXTEEN-DIAL CLOCK.

The New Cunard and White Star Steamers.

We have surely come very near the limits of size for the steamers that take the traffic of the Atlantic ferry, if the reported dimensions of the White Star steamer that is to be built to lower the record of the coming Cunarders may be accepted as correct. They are said to be 700 feet long by 70 feet beam; and the horse power is to be 30,000. Comparing this with the measurements of the new Cunard liners, they are understood to be 600 feet between perpendiculars and 65 feet breadth of beam, with a tonnage of 13,000 and a horse power equal to 26,000. The Teutonic and the Majestic, the largest hitherto of the White Star liners, measure 566 feet between perpendiculars and have a breadth of beam of 57·8 feet. The City of Paris and the City of New York measure 527 feet between perpendiculars, and are 63 feet in breadth of beam. The two White Star steamers are, therefore, already the longest afloat and have the least breadth of beam in proportion to their length of any first-class Atlantic liner, yet the proposed new White Star liner is to be 134 feet longer than the longest now afloat, while preserving the proportion of one in ten between the length and the breadth. When it is remembered that the Britannia, the first Cunarder, was only 207 feet between perpendiculars in her entire length, the jump of 134 feet all at once in the length of the longest Atlantic steamer is something astonishing.—*Glasgow Daily Mail.*

Notwithstanding the interruptions to work which have at odd intervals taken place, the construction of the two new Cunarders, Campania and Lucania, has made such rapid progress, says the *Steamship*, that the Fairfield Company find themselves in a position to arrange for the launching of the first steamer in September, a feat in shipbuilding probably unequaled in the experience of the trade. The engines and boilers are even in a more forward state, both being ready for fitting up the moment the hull is in the water. As can be understood, the engines are stupendous pieces of workmanship, and are splendid specimens of the engineering skill of Mr. Andrew Laing and his staff. The parts of the engines for the second steamer are also ready, and only await the removal of the first set in order to be placed in position. There is no doubt that the boats will now be finished well within contract time.

DOCTORS say a healthy adult should eat at least ten ounces of meat each day.

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MASTHEAD ELECTRIC ILLUMINATION.

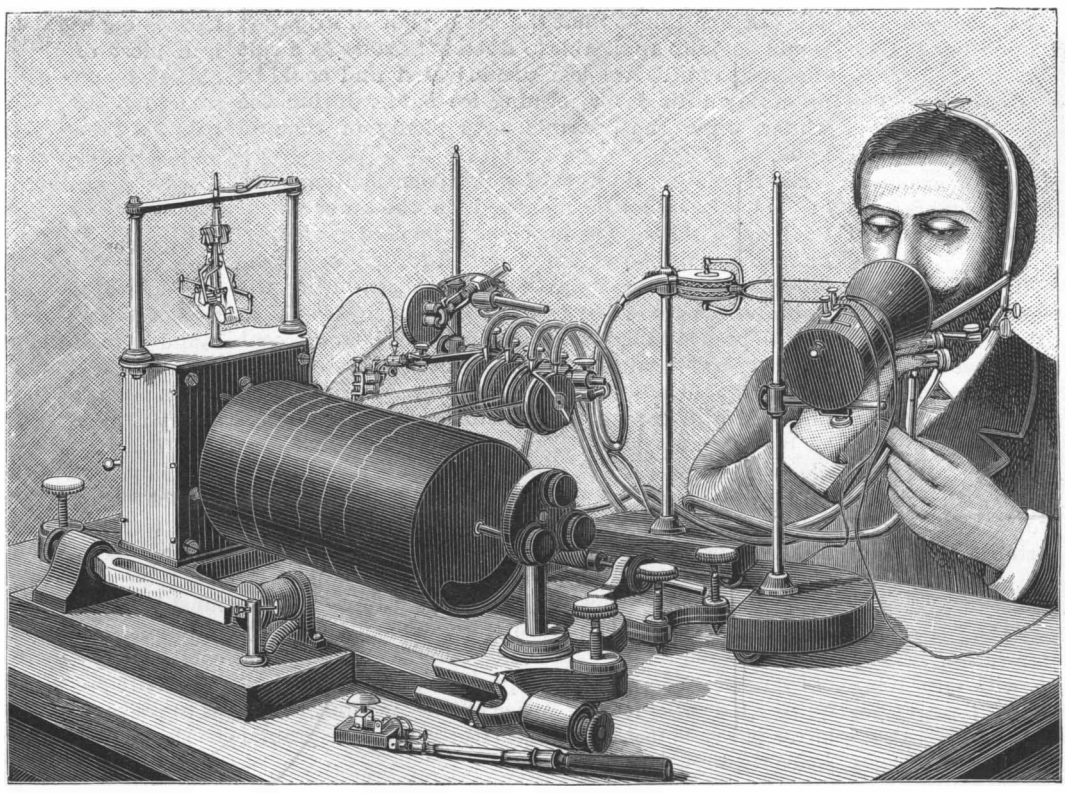
An interesting detail of naval operations in the supposed case of a war between England and France has lately appeared in *The Engineer*, London, from the pen of W. Laird Clowes, under the title of "The Captain of the Mary Rose," a tale of to-morrow. It gives particulars of various supposititious naval combats, and brings into clear light the defects as well as the powers of modern war vessels of all classes. The story is well illustrated. Among the engravings is one representing a plan for masthead electric lighting in which a zone of light is made to illuminate the waters in all directions around the ship of war, while the vessel itself remains in deep shadow. Concerning this device our author says:

"Masthead electric lights of novel design are being fitted to some of the larger battleships. These are so arranged as to shed a zone of illumination all around the vessel, but to leave the craft herself in comparative darkness, and it is confidently expected that they will be of great value should our squadrons be obliged to anchor at night within raiding distance of the enemy's torpedo boats. Some experienced officers, however, are of opinion that a ship which desires to remain exempt from attack should on no account exhibit a light of this kind, since it must of necessity be visible from a considerable distance to the foe, and they do not hesitate to say that, even if they be supplied with it, they will not use it. The advantage of the light lies in the fact that no ship so long as she employs it can possibly be closely approached by any enemy that does not expose himself to a very dangerous extent. On the other hand, it is pointed out that the apparatus is large, and offers so fine a mark for machine gun fire that it could doubtless be easily extinguished by moderately good gunners at 3,000 yards, or even more. Experts here are loud in their regrets that this device, which is quite new, in common with other electric lighting devices which are much older, has not been properly experimented with in peace time, and that, in consequence, no certainty exists as to either its practical utility or its vulnerability."

THE INSCRIPTION OF SPEECH.

Abbot Rousselot, professor at the Carmelite School, has very recently presented to the Faculty of Letters of Paris a thesis for doctor's degree which is apparently of a very special interest, for it treats of the "phonetic modification of language as studied in the patois of a family of Cellefrouin (Charente);" but this work, at first sight so limited, has a wide range, for the author definitely lays down therein the bases of a new science—experimental linguistics. Our readers already know of the important results obtained by Messrs. Rosapelly and Marey in their laboratories. It is by the aid of their labors and those of a few others, Scott, Barlow, etc., that Abbot Rousselot, in preserving the instruments of his predecessors, such as they are, in correcting them, or in devising new systems, has succeeded in creating the series of apparatus necessary for registering, one by one, the motions whose *ensemble* constitutes a word or a phrase.

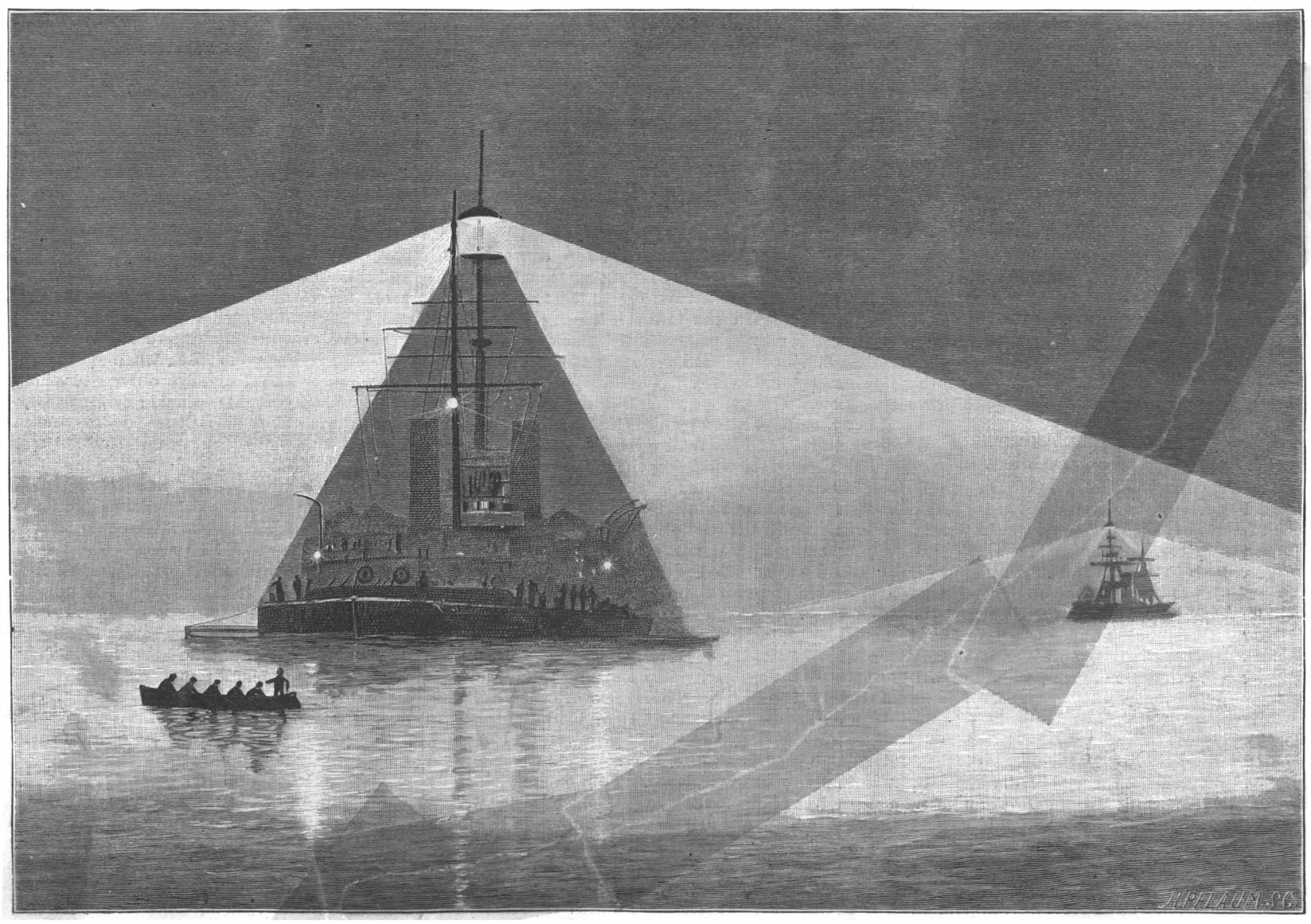
It is to be foreseen that the ingenuity of his successors, his own even, will still further improve these new apparatus; but at present the experiments made suffice to show that the problem of the mechanical inscription of speech is solved. The lines are inscribed upon the Verdin registering apparatus figured herewith. This, as well known, consists essentially of a cylinder upon which is fastened a sheet of glazed paper blackened with the smoke of a wax taper. A clockwork, with a Foucault regulator, permits of making it revolve with a speed that may be regulated at will. In front of the cylinder, upon a horizontal rod, is fixed a Marey drum and lever, made of a metallic capsule closed with sheet rubber. Against the rubber there bears a metallic plate with which is connected a horn lever that thus follows all the movements of the plate and rubber. The extremity of this lever rests upon the blackened sheet and removes the lampblack and thus draws a white line upon it. On another hand, there is an aperture in the drum into which a rubber tube may be fitted.



ABBOT ROUSSELOT'S APPARATUS FOR INSCRIBING SPEECH.

Evidently, every time that, for any cause whatever, the air contained in the rubber tube enters into vibration, the vibrations will be communicated to the air of the drum, and after this the rubber and then the plate and lever will enter into motion. If the cylinder is revolving at the same time, the line that will be inscribed thereon by the point of the lever, instead of being straight, will become a tracing—a tracing of the vibrations.

Now, if we reflect that speech is a motion and that a sound, a voice, is air that issues from the mouth and nose in vibrating under the action of the phonic organs, we shall understand the use to which the apparatus just described may be put. Abbot Rousselot does not, of course, make it note speech itself in all its complexity, but, one by one or simultaneously, all the motions that compose it. Let us begin with those of the larynx. It is here, in fact, that the first noises are produced when the air is expelled from the lungs. To the extremity of the tube that ends in the drum is adapted a metallic capsule about half an inch in diameter, which one applies to the throat, in the lateral curve of the thyroid cartilage, and then speaks. Then the vibrations of the larynx, transmitted through the skin to the column of air o



MASTHEAD ELECTRIC ILLUMINATION.

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the capsule and tube, set in motion the rubber of the drum and consequently the lever, as above explained. This gives the first trace. In order to obtain the motions of the tongue, which rises and descends when one speaks, the process is analogous, but here, instead of a capsule, a drum similar to the receiving drum is held under the chin by means of a bandage. The lever follows the motions of the hypoglossal muscle and the drum transmits the motions, as before, to the receiving apparatus. In order to have the opening and closing of the lips, a double drum connected with the two inscribers is necessary. The levers are so arranged as to form a sort of clamp, upon one branch of which each lip rests.

The nose explorer is that of Dr. Rosapelly. The rubber tube here terminates in a small bulb which is held in the nose by friction. When the air makes its exit through the nasal fossæ, as happens, for example, when a nasal vowel is pronounced, these vibrations act upon the inscriber and receiver in the same way as before.

As the registering cylinder is capable of receiving several inscriptions at once and as all the levers can be placed in the front of the drum at the same time (as shown in the figure), we shall be able to read upon it simultaneously the motions of the larynx, tongue, lips and nose. Still other apparatus that it would be superfluous to add will permit of inscribing all the accessory motions. It results that we shall have at once a certain number of lines representing simultaneously the pronunciation of a word.

In order to comprehend the importance that such inscription of decompounded speech may have, we must reflect upon the results that can be derived from it, not only by physicians, but by linguists. It will be possible hereafter to note the pronunciation of any language, dialect or idiom whatever, without relying upon the testimony of the ear, which distinguishes but slight differences between the modes of speaking of several individuals. Hereafter there is to exist a phonetics of precision.

How, in fact, do languages change from one epoch to another and from one country to another? Contemporary science has shown that there is nothing arbitrary here, and that such mutations operate according to fixed and constant laws uninfluenced by caprice or convention. Thus, to take an example, a Latin *c* placed before an *a* at the beginning of a word has given *ch*; *carnem* has become *chair*, *caput*, *chef*, and *canem*, *chien*. A *t* followed by an *i* in the middle of a word has given *is* in *poison* from *potionem* and *raison* from *rationem*. But what it has been impossible to note up to the present is each stage of these insensible, and, so to speak, microscopic transformations.

To take a contemporaneous example, one has never precisely determined, in such words as *ennemie*, *année*, the exact influence of the mute *e*, which is written but not pronounced, properly speaking, without one being able to say, however, that it is no longer heard. Now, it is always by imperceptible modifications that a phonetic change begins. We do not ourselves perceive those that are beginning, but our children will perceive them, for they will not pronounce any more accurately than we, and it is these modifications, imperceptible at first, that make of one language another tongue. By means of his apparatus Mr. Rousselot has thus already been able to note a host of variations in the same family.

This is enough to show the interest that these new instruments of study present. In the future, they will furnish our descendants with absolutely exact ideas as to our present pronunciation. As for us, they permit us to enter much more deeply into an intimate knowledge of living languages, to establish their relations and differences more closely, and, by induction, to divine what has been the progressive course of the slow evolution whence our modern tongues have issued.—*La Nature.*

Snow as Material for Irrigation.

In a paper read by Mr. A. Podolsky, C.E., before the I.R.T.S. of St. Petersburg, he says: Want of irrigation is the principal cause of the last year famine in Russia. The usual process of carrying irrigation works from neighboring streams is too costly and slow, and besides is quite impracticable in South Russia, on account of excessive small falls in all the rivers of this part of the country, the average fall being under 0·0001, or about 2·5 inch in one mile; the streams, moreover, have very little water during the summer months, when the irrigation is principally wanted.

Now in several parts of Siberia and especially in the Semiretchensky district the water obtained from melting snow is used for irrigation. The climate of these parts is quite continental, with very hot, dry summer, a severe winter, with plentiful falls of snow, and consequently very similar to the climate of middle and south Russia. The snow irrigation is managed in the following manner. At the first warm winter day after a plentiful snowfall, the whole village, not excepting women and youngsters, meet at a previously appointed spot in the fields situated on a slope of a hill. One portion, consisting of strong men, collect and carry the snow to form a large bank, while others press the snow down and spread it evenly. This operation is repeated several times during the winter, after each abundant fall of snow, and by the spring a large bank of compressed snow is formed, a dozen feet deep and weighing several hundreds of tons. With the first approach of the spring, the snow bank is covered with pine branches, straw and dung; if such material is not at hand, earth and sand are used as covering, but in the latter case the layer has to be about 18 inches thick. The lecturer thinks that the same plan of irrigation would be quite applicable to Russia, because as a rule the crests of hills are left uncultivated and could be profitably utilized for forming ice banks during the winter, when the peasants have plenty of time on hand.

For regulating the flow of water from melting snow in the bank, a ditch is managed on the lower side of the bank with two openings, one to be used as an overflow, in case the water is not wanted for irrigation, the other leads to the irrigation ditch distributing the water on the fields.

With regard to figures, the experience is too recent to yield correct data as to melting of compressed snow in large quantities, influence of various coverings, etc., but we can approximately calculate the extent of an ice bank necessary to irrigate a certain surface of arable land, as follows:

In south Russia, the water necessary to grow one "dessiatna" (3 acres) of wheat is about 2,000 tons, half of which, or 1,000 tons, might be required to be supplied by artificial irrigation. On the other hand, 36 cubic feet of loose snow weigh about one ton. Assuming that pressure will reduce the volume of snow by one-half, each ton of water will represent 18 cubic feet of compressed snow. Consequently, one acre will require 6,000 cubic feet of space in the ice bank; if the latter is say 15 feet high, 20x20 feet will be the ground space required for each acre.

Such ice banks are the cheapest and the most practicable way of irrigation for south Russia and generally for countries where snow falls in abundance during the winter.

Production of India Rubber in Borneo.

There is a royalty charged on rubber collected from the jungles of Borneo of 10 per cent *ad valorem*. The different species of the plant found are, according to the United States consul at Singapore, (1) *Manungan pulan*, which comes chiefly from Northwest Borneo; it is a *Willughbeia barbidgei*, and is specially identical with the "gutta-singgarip" of the peninsula; (2) *Maugan buyok*, said to yield the best gutta of the Borneo forest; it is a *Leuconotis engenifolius;* this species is also found in small quantities on the peninsula; (3) *Manugan manga*, which yields a very good gutta, is possibly a *Willughbeia*, as also is *Surapit*, for the latter yields the same milky exudation as *Manugan pulan*, but is said to be a bad gutta, and seldom collected. *Bertabu*, or *Petabo pulan*, is referred to as of little value as gutta, except perhaps for adulterating the better kinds. The other kinds of gutta met with in the Malay Peninsula are: (1) *Singgarip putch*, or *Gutta sudek;* (2) *Singgarip hitam;* and (3) *Gutta jelutong*—the latter is only used for adulterating.

The gutta percha production and export is much larger than the trade in India rubber properly so called. The name is given to the inspissated juice, which is produced chiefly by *Dichopsis gutta*, called by the natives *getah taban merah*, and often confused with caoutchouc. The tree is of large size, from four to five feet in diameter, and from 100 to 200 feet in height. When growing in the forest it has a clean, straight stem, and it may be generally distinguished by the rich brown color of the under surface of the leaves. The flowers are small, white, and divided into six petals and six sepals. The seeds—generally two in each fruit—are oily, and are eaten by birds and monkeys. It flowers in March, and the fruit ripens in June.

The method of collecting the gutta is as follows: A tree having been selected is felled, and as it lies on the ground rings about an inch broad are cut in the bark at intervals along the whole length of the trunk and of the branches with a parang or Malay knife. These cuts soon become filled with the white, cream-like sap, and in about half an hour the gutta will have separated from the aqueous portion of the sap, and may be removed by rolling a small ball of it round in the cuts, to the edge of which the coagulated gum adheres and forms a disk, varying in size according to the number of scores it is rolled in. These disks are then boiled in water and made into balls, and sold by the collectors to the persons who export it to Singapore and Penang. The gutta is at first white, but soon changes to pink, and finally to a brownish-red. The amount yielded by a single tree about 100 feet high, and whose age was estimated to be over 100 years, was 2 pounds 5 ounces of fairly clean gutta, valued by a Malay dealer at 3s. 3d. per pound. The product, therefore, of the whole tree is worth only 7s. 6d. Other species of the gutta tree in the Straits Settlements are: (1) *Getah toban putch* (white), (2) *Getah toban sutra* (silk), (3) *Getah toban chayas* (liquid), and (4) *Getah toban simpor*. It is stated by the director of the botanical gardens at Singapore that there are over 92 species altogether on the peninsula.

American Bauxite.

Previous to the year 1890 all the bauxite used by American consumers was imported from France; in fact, it derived its name from a town in France (Beaux) near where it was first discovered. There are very few deposits of bauxite in the United States that justify their being worked. The high percentage of silica and iron most of these properties contain renders them almost, if not entirely, worthless. There are, however, some deposits in Alabama and Georgia that far surpass the French bauxite, in that they are more soluble and contain a larger percentage of alumina and a smaller percentage of iron and silica.

Bauxite is a ferruginous hydrate of alumina ($Al_2H_6O_6$). It occurs in "beds" or "deposits," and is mined very much like iron ore in an open cut, by blasting, etc. It is found in two distinct forms; one consists of birds' eyes and fine gravel, while the other is found in the form of a donix. These birds' eyes are very rich in alumina. This ore is found sometimes between layers of clay, and in such an instance it requires a very experienced miner to separate the two, from the fact that bauxite in some of its forms resembles clay very much. This is the most deceptive of all ores; you cannot form any idea of its quality by simply looking at it, but it requires analysis all along as you progress in the mine. When this ore is being shipped, analyses must be made of everything shipped out—each car must be carefully sampled. By sampling the mine at different stages and taking therewith samples of the cars gives results from which an average can be made.

Bauxite ore should always be shipped in box cars, so as to prevent the accumulation of moisture, and has to be shipped when perfectly dry, 6 per cent of moisture generally being allowed by the consumer.

There are two companies engaged in shipping bauxite to consumers in Philadelphia, Syracuse, Buffalo, and New York, viz., the Southern Bauxite Mining Company and the Republican Company. The former company owns most of the valuable ore in Alabama and two splendid deposits in Georgia. It has been stated that the shipments of bauxite by these two companies have greatly reduced the price of aluminum.

It is useless to go into detals as to the metal that is gotten from bauxite (aluminum), for upon that subject much has already been said. From the present outlook it is destined to be the coming metal, its lightness, durability, and the fact that it does not oxidize being recommendations that no other metal has. In nature aluminum exists very abundantly, and goes to make up a large portion of the earth's crust. Common clay contains about 30 per cent of aluminum, but in view of the fact that it exists in a combined form renders it difficult to separate.

The following is an average analysis of the ore found in Alabama and Georgia:

Alumina	55 to 60 per cent.
Silica	6 " 10 "
Iron	5 " 6 "
Water	24 " 30 "

The method for bauxite analysis is very simple. However, great care should be taken in the sampling, for upon that depends the accuracy of the result.

Method for Analysis.—Weigh out 2 grammes of the finely ground ore and place in a platinum crucible with cover on; place over flame and heat gradually at first, and then raise the heat to redness; allow this to continue for 15 minutes; remove crucible and allow to cool; weigh, and calculate loss as water.

To the crucible containing the dried powder add sodium carbonate and fuse; when at quiet fusion, remove crucible and dissolve out contents with water and a little hydrochloric acid; evaporate to dryness; take up with as little HCl as possible and water; filter and wash well with hot water; make up solution to 300 cubic centimeters; shake well to mix; take out 50 c.c. and determine the alumina by precipitating with ammonia; take another 50 c.c. and determine iron by usual method. The silica is also determined as usual.

A SEPARATE building at the World's Fair for the shoe and leather industry exhibit is now an assured fact, as the required $100,000 has all been raised. Leather dealers and manufacturers in all parts of the country have contributed to the fund. The building will be one of the handsomest on the grounds, having been designed by Sandier, an eminent French architect, now connected with the fair. It will measure 150 by 575 feet, and will contain everything in the way of leather and the products of leather exhibited at the fair. The most improved machinery used in leather manufacture will be shown, as also the manufacturing processes. The visitor may watch this from the rawhide to a finished shoe or dainty slipper. It is likely, too, that rubber goods and their manufacture will be shown in this building. Altogether the exhibit will be far larger and more complete than anything of the sort ever before attempted.

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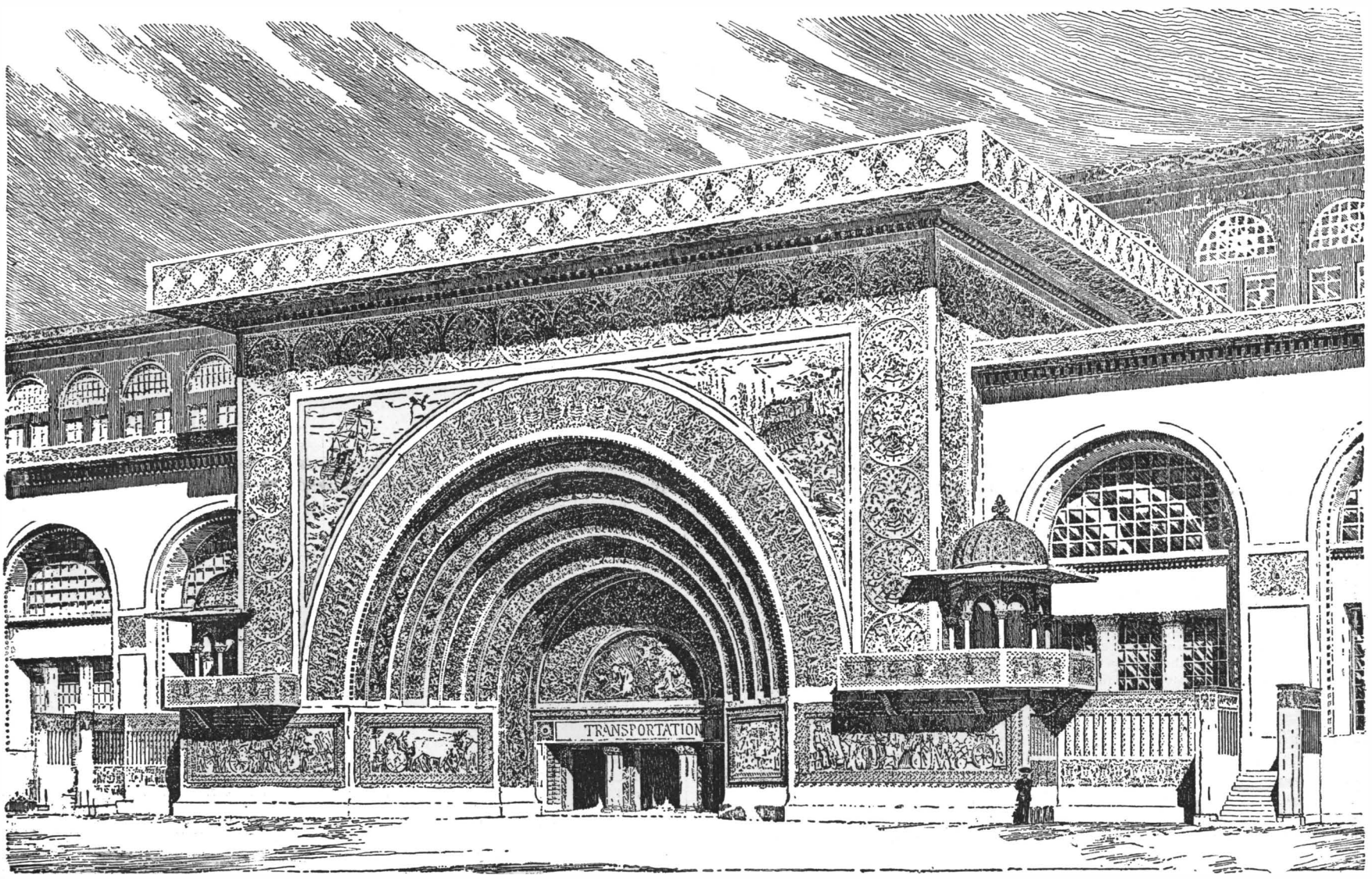
Mechanical Properties of Soils.

The property of absorbing and retaining moisture is important. Clay loams and peaty soils absorb the largest quantity of moisture and retain it best, especially those peaty soils which have a large excess of organic matter in them. Pure clay soils are generally too compact, while sandy soils are too loose either to absorb or retain moisture. On level clay soil the water will stand and become stagnant. This is the case, also, with sandy or peaty soils with a clay subsoil. Under these circumstances draining is necessary.

The air should be allowed to circulate freely through the soil. It carries the elements of plant food contained in it to the roots. Carbonic acid gas and ammonia are both furnished in this way to a considerable extent. It promotes the decay of vegetable matter present, and thus again provides food for plants. The proper chemical changes in the mineral elements of the soil are promoted by the carbonic acid and the oxygen of the air. How necessary, then, that the soil should be well plowed and well pulverized.—*Florida Farmer.*

THE GOLDEN DOOR OF THE TRANSPORTATION BUILDING OF THE WORLD'S FAIR.

The accompanying engraving of the beautiful golden door of the Transportation Building of the World's Columbian Exposition affords, even in the absence of the beautiful coloring which will characterize it in its completed state, a very good idea of what promises to be one of the most notable architectural features of that wonderful architectural display. The dimensions of this door, as well as those of the building itself, have been so frequently published that it is useless to again reproduce them, but the accompanying sketch will give an excellent idea of the design and appearance of the work when completed.—*The Railway Review.*



GOLDEN DOOR—TRANSPORTATION BUILDING OF THE WORLD'S FAIR.

A New Material for Pathological Models.

At a recent meeting of the New York Pathological Society Dr. George C. Freeborn presented specimens illustrating their use. For purposes of instruction models are often very useful, but as usually made they only present three dimensions, length, breadth, and thickness. In many cases it is desirable to illustrate some of the physical properties of the object, *e. g.*, flexibility and elasticity, these properties being especially useful in models of some of the histological elements. With the mass to be described these two important properties have been gained.

The mass used in making these models is a mixture of glue and glycerine, or of gelatine and glycerine, the former being more economical and giving an opaque model, and the later yielding a transparent model. The proportion of the ingredients varies according as a more or less flexible mass is wanted. A mixture of equal parts of glue or gelatine, by weight, and glycerine, makes a firm, fairly flexible mass. By increasing the quantity of glycerine to two or three parts, a less firm but more flexible and elastic mass is obtained. In the author's experience, the most useful proportions are one of glue or gelatine and two of glycerine.

In making the mass the glue or gelatine is soaked in water until it has become soft, then all the surplus water is drained off and the soft mass added to the glycerine, which has been heated on a water bath. When the glue or gelatine has become melted, the thick, tenacious mixture is strained through cheese cloth, and again heated on the water bath for at least an hour to drive off the water. If this is not done, the evaporation of the water, after the model is cast, causes considerable shrinkage.

Any desired color can be given the mass by adding to it, while melted, a concentrated solution in water of an aniline dye. Care must be taken not to add an excess, or it will cause staining of the hands upon handling the model.

Making the Model.—He had found paraffine the most useful material for making the model from which the plaster mould is made. Other materials, such as wood or clay, may be used, but paraffine is preferable, on account of the ease with which it can be melted out of the mould without damaging it. The paraffine is cast in a block or slab, in a wooden frame placed on a smooth, level surface. When cold, the wooden frame is removed and the block is ready for shaping into the model. In casting slabs, the melted paraffine is run into tin trays of the desired size and depth.

The outline of the model to be made is drawn on thick brown paper, and cut out with a sharp knife or scissors, and is then placed on the slab of paraffine as soon as it has become solid, but while still plastic. With a thin and narrow knife blade, the edges of the paper pattern are followed around, carrying the point of the knife down to the bottom of the tray. This cuts away all the surplus paraffine, which can then be pulled out of the tray. The outline model is now allowed to become perfectly hard before it is removed from the tray. The model is next brought roughly into shape by shaving with a sharp knife, still further smoothed by gentle scraping with glass, and finally finished by rubbing with bits of cloth moistened with turpentine. The model is always made in two parts, and a mould made of each.

Making the Mould.—The model is placed on a well oiled, smooth surface, the plane side of the model down, and a frame built around it with strips of wood. Plaster of Paris mixed into a cream with water is then poured into this frame until the highest point of the model is covered to the depth of at least an inch. After this has set, the frame is removed, and the mould stood up in a tray. The model is melted out by allowing the flame of a Bunsen burner to play against it, after which it is given three coats of shellac varnish, each coat being allowed to dry thoroughly before applying the next.

Casting the Model.—Both halves of the mould are placed in a perfectly level position and the surfaces and depressions well oiled. Each half is now filled with the melted mass until it projects slightly above the surface of the mould, using the mass at as low a temperature as possible, in order to avoid contraction of the model on cooling. When perfectly cold, the two halves are joined in the following manner: Remove one half of the model from its mould, then paint the exposed surface of the second half, still in its mould, with some of the modeling mass at a fairly high temperature, next place the other half on it, and adjust its edges to the half contained in the mould. After two or three hours remove the complete model from the mould, cut away all rough spots at the line of junction, and finally finish by painting with a brush wet with boiling water.

All finished models should be preserved in their moulds, to avoid distortion. The mass is likely to prove useful in making casts of irregular surfaces and cavities, as, on account of its flexibility, it can be easily removed without damaging the object, when a plaster cast would either break the object or be broken itself. To illustrate this adaptation of the process, Dr. Freeborn exhibited a cast of the base of the human skull He also presented models of a red blood cell, from the human subject, and also from the frog, a crenated blood cell, and several nerve cells.—*N. Y. Medical Record.*

The Ideal Family Physician.

The Hon. Thomas F. Bayard recently addressed the class at one of the medical colleges in Baltimore, having for his theme, "The Lawyer and the Doctor." It has been his fortune, he says, to be thrown in contact with not a few medical men who have been "as the salt of the earth" in their respective communities. A man who is already eminent by reason of his natural endowments may be said to double his talent by becoming a physician. "It has been my personal fortune," says Mr. Bayard, "to know such a man. It has been my privilege and delight to accompany him in visits where his only medicines were the personal presence and conversation of the man himself. He had shared and had lessened their anxieties; counseled the wayward; cheered the weak-hearted; had rejoiced with them that rejoiced, and wept with the weeping. And I have seen such a man so surrounded by an atmosphere of love and trust, holding, as it were, the heart-strings of a family in his hands, their guide, philosopher, and friend; and then I realized what a moral force in society the profession, properly comprehended and properly followed, was capable of exerting, and how relatively small a part of its usefulness was the administration of medicine."—*N. Y. Medical Journal.*

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RECENTLY PATENTED INVENTIONS.

Engineering.

EXHAUST NOZZLE.—Charles W. Umholtz, Bristol, Va. This invention provides an improved locomotive exhaust having a main central and supplemental surrounding passage, but with the nozzle proper independent of and detachable from the standpipe and supported upon vertical pins projecting from the top of the latter, which also has a vertical flange surrounding the base of the nozzle, but separated from it by a narrow space, which serves as the exterior or supplemental steam passage. Through this supplemental passage the steam has practically free exit, and the nozzle proper may be readily detached when required.

VALVE GEAR.—Fred. E. Smith, Boston, Mass. A rocker is yieldingly connected through springs with the eccentric rod, the rocker being also connected with the valve stem and, by a piston, with an auxiliary fluid cylinder, preferably containing oil, the ends of the cylinder being connected by a pipe. The movement of the rocker is thus controlled by the speed with which the fluid passes from one end of the cylinder to the other, so that the valve will always travel at a constant rate of speed, and prevent racing of the engine, giving a uniform motion to the driving shaft.

Railway Appliances.

CAR COUPLING.—Charles W. Stillians, Pueblo, Col. This device is more especially designed for a freight car coupling. A normally elevated vertically sliding link tilter is located in the rear of the link-engaging portion of a coupling hook or arm pivoted in the drawhead, in connection with mechanism for raising the coupling hook and depressing the link tilter. The coupling is strong and durable, and may be operated without danger to the trainmen, and the coupling link may be readily raised or lowered to suit opposing cars of different heights.

CAR COUPLING.—Hampton K. Smith, Union, S. C. This coupler comprises a drawhead capable of an interlocking connection with an opposing drawhead, while valve heads are carried by the drawheads to receive the air pipes for air brakes or steam pipes. The valve heads are so constructed that when the heads of two opposed couplers are brought together a connection is established between the steam or air pipes of the heads, and when the drawheads are uncoupled the valves in the heads automatically seat themselves and prevent the escape of steam or air, the connection and disconnection of the pipes being thus automatically effected.

ILLUMINATING TRACKS.—William E. Ferguson, Montclair, N. J. This invention provides means whereby one or more lights may be arranged between the rails of a track for lighting up the roadbed, the lights being so arranged that trains may pass over without injuring them. A board having battens on its under face at each end engages the webs of opposite rails, and pendent from the board is a series of hangers, in which are held electric lights, brought in circuit in the usual manner.

Mechanical.

CLUTCH.—Daniel T. Denton, Duluth, Minn. A strong, durable, and effective friction clutch is provided by this invention, the friction faces of which may be held in contact without exerting longitudinal or endwise pressure on the shaft, while the clutch gear is idle and does not rotate when thrown out of gear or out of frictional contact, thus enabling the operator to make adjustments or alterations or repairs without stopping the rotation of the shaft. The construction is such that the whole clutch and frictional device may be made in halves or sections when used with the split pulley, thus enabling it to be placed on the shaft without removing the latter.

Miscellaneous.

MUSICAL INSTRUMENT.—Dwight Kempton, Summerland, Cal. An improvement designed to greatly enrich the tone of stringed instruments, such as pianos, and whereby also the weight of the instrument may be reduced, has been devised by this inventor. It consists of a series of harmonic sections, each comprising an independent stringed supporting bar provided with a bridge and pins for holding the strings in place. Each harmonic section carries as many strings as are necessary to produce the desired tone, the hammer striking the series of strings simultaneously, and the several sections are placed sufficiently apart to make them independent of each other.

PENCIL POINTER.—Frank E. Flagg, New York City. The casing of this device has a socket plate with a conical bore to receive the pencil, the bore extending through a beveled face of the plate, while a disk having a beveled inner face and attached abrading material is held to revolve in close proximity to the beveled face of the socket plate, a clamp holding the pencil and a driving mechanism being connected with the disk and the clamp. The device is of simple construction, and is adapted to rapidly and perfectly point a pencil, producing a point as long as may be desired.

EASEL ATTACHMENT.—Henry J. Muhlfeld and Frank J. Spillane, New York City. To enable a student to sketch from casts or life in a crowded school room, the canvas or drawing board needs a support and adjustment not easily obtained, an object this invention is designed to facilitate, providing therefor an attachment for chairs or other supports consisting of vertical supporting rods adjustable toward and from each other, and supports for such rods, there being picture supports mounted on the upper portions of the rods. The device consists of two sections, each attached to the vertical side rail of a chair back at the back.

WINDOW CHAIR.—Adolph Boettcher, South Stillwater, Minn. This is a scaffold or chair constructed in two side sections, adjustably connected by a bar, forming a light and strong structure, which can be quickly fastened in a window to extend outward beyond it, being readily removable from one window to be carried to another. A guard rail may be used in connection with the device, and it is also well adapted for household use in the cleaning of windows, while it may be compactly disposed of when not in use.

VELOCIPEDE. — Martha E. Slocum, Meadville, Pa. The depending seat frame of this vehicle has outwardly projecting arms at its upper end, on which the hubs of large wheels are journaled, one on each side, an arm or arms rigidly mounted on the same axles carrying a supplemental small wheel or wheels. Motion is communicated from the treadle by sprocket wheels and chains to the axles of the large wheels, and the machine is designed to be especially safe and easy riding, so that it can be used by the most timid persons.

WHIP SOCKET.—Henry E. Schreader, Manteno, Ill. This invention relates to whip sockets having locking devices to prevent the whip from being abstracted. The socket has at one side a lock case, in which is a transverse slide rack with an external operating handle, there being a whip retainer at the inner end of the rack, the latter being engaged by a toothed latch, and a series of sliding tumblers engaging the latch. Keys having projecting finger pieces are pivoted in the case in engagement with the tumblers, and by changing the relative positions of the latter a great variety of combinations is made possible.

SIDE REFLECTOR.—Charles E. Plumtree, Spokane Falls, Washington. A reflector support which may be readily applied to any lamp is provided by this invention, the arrangement being such that the reflector can be moved to any position to throw the light where desired. The support has a collar secured by a set screw to the burner or other part of the lamp, a ring sliding in this collar having a socket in which is held an adjustable bar, from which the reflector is supported, the adjustment being maintained by set screws.

ADDRESSING MACHINE. — John P. O'Malley, Manistee, Mich. A type galley containing a series of addresses, at spaced distances apart, is supported on a longitudinally sliding carriage in a suitable frame. An impression block operated by a treadle effects the impression as the paper or envelope is held over the type bearing the desired address, and when the pressure is removed from the treadle the carriage holding the type galley is automatically moved forward the distance between two sets of addresses, the operation being repeated as many times as there are separate addresses on the galley.

SNATCH BLOCK.—Adams C. French, Seattle, Washington. This invention provides an inexpensive and durable block for hoisting purposes, which may be readily detached from its hook, and which is connected with the hook in such a way that the frame cannot spread. The construction is very simple, and the parts may be easily detached or united.

PUMP. — Melchi M. Grove, Garfield, Washington. This is a simple form of pump, which may be partially submerged in water, and which, by means of air pressure applied to the chambers, is designed to pump water rapidly. It is a pump which may be used for any ordinary pumping purposes, but is especially intended for irrigation, the invention covering various novel features of construction and combinations of parts.

GRAIN CUT-OFF.—Philander D. Thompson, Neligh, Neb. This invention relates to a combined cut-off and delivery spout for feed hoppers in granaries, elevators, and mills, providing a device which is inexpensive, and which can be operated either to cut off the supply completely or to cut it off from one point and direct it to another. The construction is designed to prevent the escape of any grain between the operating parts to clog the machine, and the various openings are made to register accurately, whereby friction is avoided.

STOVEPIPE COUPLING. — Francis P. Hart, Strasburg, Pa. This coupling consists of a sleeve piece having one end folded to double its thickness, and longitudinally notched, the unjoined edges of the sleeves having hooks folded internally, and a thin wedge being insertible within and between the hooks. The device is designed to facilitate the making of a neat and secure connection between the ends of stovepipe sections, whether the sections are adapted to slip-joint together or are of equal diameter where joined.

ANIMAL SHEARS.—Charles and Harry Burgon, Malin Bridge, near Sheffield, England. This invention relates to improvements in instruments for shearing or clipping sheep or other animals, and provides improved means for applying and adjusting the pressure of the upper cutters upon the lower cutters, relieving the axis of the vibrating lever as far as possible from all bending strain. A spring latch retains the axis of the swiveling crosshead of the lever in its socket, while permitting it to swivel freely and allowing of its easy insertion and removal.

WINDOW FRAME AND SASH.—John Anderson, Hickson, North Dakota. According to this invention, one of the parting beads and one of the inner beads of the window frame are provided with a movable section, connected crank shafts in the frame connecting the movable beads to move them to and from the sashes, to permit the latter to swing outward. The attachment may be conveniently added to any window frame, and by its use the sashes may be swung outward to stand at a right angle, so that both sides of the glass may be conveniently cleaned.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

RAILWAY CAR CONSTRUCTION. By William Voss. New York: R. M. Van Arsdale. 1892. Pp. 177. No index. Price $3.

Railway car construction, under the auspices of the Master Car Builders' and Master Mechanics' Associations, has reached a definite standard. The object of the present work is to describe in detail the improved construction of all kinds of cars and of all their parts, by the aid of very numerous illustrations. This idea is very adequately carried out. The work, we should conceive, is one which would be indispensable in the car factory, as the numerous dimensions quoted on the plans give them all the meaning of a large scale drawing. The publisher is the proprietor of the *National Car and Locomotive Builder*, and is therefore peculiarly well situated for publishing such a work. "Interchange of traffic codes," as adopted by the Master Car Builders' Association, are embodied, with illustrations as required. The work is without index, but its place is supplied by a very full table of contents.

HIGH MEDICAL CULTURE. By W. R. Dunham, M.D. Cambridge: Printed for the author. 1892. Pp. 225. No index. Price $1.

The author of this work believes that the present tendency of the schools is to teach medical practice without the science, and, as far as they attempt to teach medical science, to teach it incorrectly. The work is radical and claims to touch on medical science as based on the four vital properties of laws of organic force. One theory which he enunciates is that medicines by their presence provoke the various organs to increased, diminished or modified action, but are without action of their own.

THE METAL WORKER ESSAYS ON HOUSE HEATING. Arranged for publication by A. O. Kittredge. New York: David Williams. 1892. Pp. 407. Price $3.

This work is the outcome of prize essays on steam, hot water and hot air heating of dwellings, originally published in the *Metal Worker*. These essays are reproduced, together with a number of letters of criticism upon the prize essays, which letters were also originally published in the *Metal Worker*. The criticisms give a vivacity to the work which might have been found wanting in the more formal prize essays. A valuable feature is the addition of a section on the proportioning of radiating surfaces. The solution of this problem is precisely the great desideratum for practical work, and we welcome its publication in accessible form.

BULLETIN OF THE PHILOSOPHICAL SOCIETY OF WASHINGTON. Vol. XI. Washington: Printed by Judd & Detweiler. 1892. Pp. xxxi, 618.

Quite a large range of scientific subjects is contained in this volume of reports. Geology and astronomy are perhaps the controlling motives of the proceedings. A contents and exhaustive index are embodied in the work. The volume makes a very large octavo and testifies to the scientific activity of the society.

ELEMENTS OF MACHINE DESIGN. By J. F. Klein. Bethlehem, Pa.: The Comenius Press. 1892. Pp. vi, 212. Price $6.

Professor Klein has published the foregoing elements with notes and folding plates for the use of students in the Lehigh University, where he holds the chair of mechanical engineering. The work is profusely illustrated with cuts in the text as well as large plates. The index gives four columns of reference—to the page, to the formula number, to figures and plates and to the page number of tables. After the index, which may be referred to as a real model in its way, an appendix of gear tables is given.

STREET RAILWAYS. By C. B. Fairchild. New York: The Street Railway Publishing Company 1892. Pp. vii, 441. Price $4.

The above work is of interest as testifying to the enormous extension of the street railway industry. The introduction of electric and cable traction has greatly expanded the field of work. The subjects of electric, cable and horse traction, with a short notice of steam, air and gas motors, open the book. Elevated roads, tower building, track construction, discipline and rules for employes and passengers, together with the charters, franchises, bookkeeping, and street railway accounts, are the general topics included. The treatment is as practical as the titles above summarized would indicate. An interesting feature of the work is contained in Chapter 13, in which different types of street cars, 47 in number, built by 18 representative car-building companies of this country, are illustrated.

FOURTEENTH ANNUAL REPORT OF THE STATE BOARD OF HEALTH OF THE STATE OF CONNECTICUT. For the year ending November 30, 1891. With the registration report for 1890 relating to births, marriages, deaths, and divorces. Printed by order of the legislature. New Haven: Tuttle, Morehouse & Taylor, printers. 1892. Pp. xxxvii, 447, 202.

PRIMITIVE MAN IN OHIO. By Warren K. Moorehead. G. P. Putnam's Sons. 1892. Pp. xv, 246. Price $3.

The deeply interesting work in archæology and anthropology executed in Ohio during the recent years with particular reference to late discoveries is given, in this book in most attractive shape. Numerous views of scenery and implements and plans of mounds and allied subjects give a vivid aspect to this treatment of an exceedingly popular subject. We note especially several references to Professor Putnam, who of late years has given considerable attention to Ohio anthropology, in the interests of the Peabody Museum.

SADDLE AND SENTIMENT. A story of the turf. By Wenona Gilman. The Outing Company, Limited. 1892. Pp. 284. Price 50 cents.

Horse racing, the development of man's noblest servant, under the auspices of the enthusiastic Kentucky horseman, the excitement of the race track interwoven with a thread of romance so as to weave the whole into the form of an attractive novel are the matter of "Saddle and Sentiment." It is enlivened by numerous illustrations, and will, we believe, find numerous readers.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

INDEX TO NOTES AND QUERIES.

	No.
Chemicals	4508
Dynamo construction	4503
Engineering	4512
Electrical	4505, 4506
Preserving food products	4506
Gas and steam engines	4507
Pneumatic street cars	4515
Recovery of bodies that are drowned	4513
Thunder	4504

(4503) H. B. P. writes: 1. Some arc dynamos, the Wood for instance, have two brushes on each side of the commutator, with several bars of the commutator between them. Kindly explain the reason for using the two brushes. What advantage is gained? Why is no arc formed at the brushes by the short-circuited coils? A. The object in arranging the brushes as stated is to cut out a portion of the armature winding, thus reducing resistance and giving the conductors time to cool. 2. I have been told that arc lamps connected in multiple series on an incandescent circuit will consume the + and — carbons equally fast. Is such the case? A. This will not occur unless the carbons are of unequal size, or unless the current is an alternating one. 3. Will you advise me if there is any book on arc lamps?—the trouble in them, how found, and remedied? A. There is no book treating on arc lamps of all descriptions. We believe that most manufacturers of arc lamps publish information for the benefit of users.

(4504) G. M. R. asks: How is the noise we call thunder produced or caused? Is a side crank on steam engine stronger or in any way better than a center crank? Why does oil or any other lubricant aid a cutting tool in metal, since it certainly cannot touch the cutting edge? Experience has shown that lard oil used in cutting a thread for a tap makes a smoother job than most other oils, and as it could get no nearer the cutting edge, I fail to see what different action it has. A. The cause of thunder and of its prolonged noise is not well understood. According to some the action is similar to the explosion of powder in a gun. When lightning strikes a tree or building, the noise is intensified by the sudden disruption of the solid material, as the splitting of a tree or the tearing apart of the materials of a building. All lubricants depend upon their conductivity of heat to keep the edge of the tool and the metal operated upon, cool.

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Their capacity to resist evaporation by the heat generated at the cutting edge, with their capillary power, gives the varying qualities to various lubricants. Lard oil, in addition to its high evaporating temperature, has a peculiar spreading or capillary property, which draws it in between the chip and the tool, thereby lessening the friction and absorbing the heat.

(4505) G. A. W. asks: 1. I have a Grenet battery about 1⅛ or 2 volts and I would like to make an induction coil to use for giving shocks to people. Would you kindly let me know about how to make it? A. You will find a description of a shocking coil in SUPPLEMENT, No. 567. 2. Also could you let me know what will keep catsup from fermenting or going sour? Some people let it ferment before they boil it into catsup, but then it is so sour that it is not fit for use. Others put some kind of drug into it to keep it from fermenting. If you can tell me what to put into it to keep it all right, I would be very happy. A. Salicylate of soda has been discovered to exert a very decided chemical action in checking alcoholic fermentation, in this respect being somewhat similar to borax, although much more energetic. A small quantity of the salicylate will entirely arrest the fermentation of wine and also of milk. 3. Also would you tell me a good way to test vinegar to tell the strength of it? The way I tell is by taking 1 ounce vinegar and then put soda in to see how much soda it would take before it kills the acid in it. A. An accurate carrying out of the process you employ will give satisfactory results. 4. Also what is a non-poisonous color to color pickles (cucumbers) with? I use now burnt sugar, but I would like to know something better. A. Put a handful of spinach leaves in the boiling vinegar, which thereby acquires a green coloration, which it imparts to the pickles. This method is harmless; any receipt using any form of copper cannot be condemned too strongly.

(4506) G. H. L. asks: 1. How can I determine the voltage and amperage of an incandescent electric lamp? A. By measuring the resistance of the lamp and taking number of ohms and dividing electromotive force by the resistance, you will find the amperage. The voltage is usually marked on the lamp. 2. How are carbon filaments made? A. Carbon filaments are made by carbonizing slender strips of bamboo in a vessel from which the air is excluded. 3. What is the pressure in weight of air on a vacuum per square inch? A. About 15 pounds. 4. How can I tell when all the air is out of the receiver of an air pump? A. It is practically impossible to exhaust all the air from a receiver. You can tell the degree of exhaustion by means of a manometer made for the purpose, or a very high vacuum is indicated when the spark of an induction coil will not pass between points located in a vacuum chamber and separated by a distance of one-sixteenth of an inch. 5. Can a patent be issued to a minor? A. A minor's patent must be applied for by a parent or guardian.

(4507) E. B. asks: 1. Suppose two cylinders were filled, one with steam at 1 pound pressure, the other with an ordinary gas mixture at 1 pound pressure. The gas is exploded and free to expand at the same time the steam is free to expand. What would be the proportionate volume of the two vapors after expansion? A. The steam would expand about one-fifteenth of its volume; the explosive gas mixture would expand from four to eight volumes according to composition and amount of air contained. 2. I want to maintain a pressure of 30 pounds in an air tank with a constant outlet ⅛" x ⅛". I can run my pump at 150 revolutions. What should be the diameter and stroke of the pump? A. If the pump is single-acting, it will require a cylinder 1⅛ inch by 2⅛ inches stroke.

(4508) A. H. asks what tri-sodium phosphate is made of. A. Acid calcium phosphate, made by decomposing bone ash with sulphuric acid, is precipitated with a slight excess of sodium carbonate. By crystallization disodium phosphate is separated from the solution. The crystals are dissolved in water and caustic soda is added in proper quantity to form the trisodium phosphate, which is separated by crystallization.

(4509) O. D. asks: What causes brass to break when bisulphate of mercury is applied to it? A. The mercury being reduced from the bisulphate forms an amalgam with the brass, which is weaker than the unamalgamated brass.

(4510) G. K. C. asks: Can a sheet of mica be softened by any process? If so, how? A. No. It is sometimes ground up and mixed with shellac and the mixture moulded by heat and pressure.

(4511) H. P. S.—The plant is *Cassia nictitans*, "wild sensitive plant."

(4512) K. M. I. says: Suppose a reservoir stands 100 feet or more above the point of discharge of a line of pipe and all points in the pipe line to be below the level of reservoir, is it known to engineering practice that not a drop of water might be discharged at the outlet, owing to the presence of air in the pipes? An individual supposed by many to be eminent authority has told me that he himself was an eyewitness to such a phenomenon. He also told me that he could philosophically account for it, but that it would take too long a time to explain it to me. A. The condition of resistance of air as stated is well known to the engineering profession. If there are inverted siphons in the line of pipe, with uptakes in all, amounting to as great or greater height than the total height of the head, there will be no flow of water through the pipe. The theory and fact is that the water separates from the air in the siphons, occupying the rising leg, while the air remains in the downslope leg. When the water has reached the last uptake, which represents a greater height than the whole height, it will stop. Drawing the air from the bottom of the siphons relieves the back pressure.

(4513) L. P. G. asks: 1. Is it true that drowned bodies which have sunk may be brought to the surface of the water by firing heavy guns? A. It is said that sunken bodies have been brought to the surface by firing cannon near the spot. 2. If so, what is the scientific explanation of the fact? A. The vibration or shock of the discharge is supposed to liberate or expand confined gases in the body, making the body lighter by its enlargement. 3. Is it dangerous to leave windows open during a thunder storm? A. It is safer to close windows during a thunder storm. 4. If so, why? A. There is some danger that a current of warm moist air from the interior of the room may act as conductors for the discharge. The building too acts as an electric screen. 5. How and where can I obtain full reports of all the speeches made in the House of Representatives and in the Senate on the McKinley bill? A. Address Congressional Record, Washington, D. C., for copies containing speeches, etc.

(4514) F. S. T. says: In a complete vacuum A says that the attraction the earth has is the same to a feather as it is to a cannon ball weighing 10,000 pounds, and if dropped from the same distance that they would both reach the ground together. B says the cannon ball would reach the ground first. Who is right, A or B? A. A is correct. It is only in the atmosphere or other resisting medium that the ball will have the fastest fall.

(4515) A. W. N. says: I understand that pneumatic street cars are a success, but that stations are required to charge the cylinders. Would not a small 1 or 2 horse power steam motor and air pump, continuously running on board the car or adjoining car, charge an 8 or 10 horse power air engine? The frequent stopping and down grades furnishing ample time to keep up the required amount of pressure. A. The condition of power accumulation as stated would be a millennium in mechanics. The realization of air motor power is now but about 40 per cent of the initial power. There is progress proposed and now being put into operation, so that by the heating of the compressed air in the motor car an efficiency of over 60 per cent may be realized.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

August 23, 1892.

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Aeration of liquids, E. Williams ... 481,249
Air compressor pistons, speed regulator for, E. C. Fasoldt ... 481,527
Alkalies and chlorine, production of caustic, F. M. Lyte ... 481,407
Auger, earth, F. W. Brocksieper ... 481,345
Automatic brake, J. H. Priestley ... 481,190
Axle threading tool, J. C. Stuchel ... 481,514
Bales, device for drawing tie bands around, Martin & Brownfield ... 481,184
Bar. See Cutter bar.
Barrel, G. H. Forster ... 481,350
Barrel head beveling machine, H. Theis ... 481,335
Barrow wheel, Crossland & Long ... 481,298
Bed, billiard table, etc., combined folding, R. N. Barger ... 481,385
Bedbug trap, F. F. Baggesen ... 481,270
Bed pan, S. A. Smith ... 481,375
Bicycle, W. S. Cranmer ... 481,476
Bicycle, A. Winton ... 481,536
Bicycle lock, F. Egge ... 481,290
Bicycle lock, E. W. Macauley ... 481,236
Bicycle saddle, A. L. Garford ... 481,538
Bicycle wheel, F. Ashley ... 481,460
Billiard cushion, M. Bensinger ... 481,387
Bit. See Bridle bit.
Blacking holder and rest, shoe, R. D. McManus ... 481,265
Bleaching, J. A. Myrick ... 481,414
Blind, Venetian, C. G. Christensen ... 481,473
Block. See Engraver's block. Stone paving block.
Board. See Center board.
Boilers, water jacket and condensing apparatus for marine, T. L. & T. J. Sturtevant ... 481,379
Book support, J. A. Muir ... 481,505
Boring and mortising machine, G. A. Adams ... 481,383
Boring and shaping machine, A. K. Phillips ... 481,307
Bottle stoppering device, M. L. Macauley ... 481,363
Bottles, etc., device for cleaning, C. F. Woessner ... 481,537
Box. See Dice box. Stuffing box.
Brace. See Universal jointed brace.
Bracket, D. M. Ireland ... 481,177
Brake. See Automatic brake. Car brake. Sled brake. Vehicle brake.
Brick machine, T. T. Wood ... 481,454
Bridle bit, C. E. Hein e ... 481,172
Brush, revolving hair, W. J. Miller ... 481,264
Buckle, J. A. Traut ... 481,213
Burial casket, J. N. Pruser ... 481,370
Burner. See Hydrocarbon burner.
Cable grippers, automatic release for, A. J. Smith ... 481,431
Cable traction system, G. Muller ... 481,413
Camera shutter, W. H. Bristol ... 481,343
Can for oil, etc., A. E. Kuhns ... 481,233
Candlestick, J. P. Daleiden ... 481,225
Candy, machine for forming shapes of, C. M. Kurtz ... 481,234
Car brake, C. A. Dahlstrom ... 481,163
Car coupling, J. C. Carrick ... 481,525
Car coupling, W. B. Clark ... 481,325
Car coupling, C. Demaurez (r) ... 11,265
Car coupling, W. H. Harris ... 481,399
Car coupling, W. H. Violett ... 481,446
Car coupling, E. C. Welch ... 481,449
Car gate, railway, L. Arnold ... 481,540
Car sanding device, street, J. H. & G. L. Vogan ... 481,535
Car seal, F. W. Brooks ... 481,388
Car, street, F. B. Brownell ... 481,467, 481,468
Car ventilator, railway, W. S. Rogers ... 481,196
Card, Christmas, C. Heymann ... 481,173
Carding engine for grinding revolving flats when in situ, J. Edge ... 481,228
Carding engines, device for supporting and adjusting the front and back covers of, W. P. Canning ... 481,222
Carrier. See Cash carrier. Log carrier. Reel carrier.
Carving machine, J. K. Rishel ... 481,372
Cash carrier, G. P. Kenney ... 481,178
Cash register, C. Leni ... 481,361
Cash register and indicator, G. M. Howe ... 481,495
Cash register and indicator and check machine, W. Aldrich ... 481,459
Cas register, indicator, and recorder, C. F. Brown ... 481,524
Casket handle, J. D. Ripson ... 481,531
Casting car wheels, chill for, C. A. Treat ... 481,442
Castings, making malleable iron, B. Talbot ... 481,313
Centerboard for boats, F. M. Eaton ... 481,484
Chatelette, programme and score card, E. R. Roehm ... 481,195
Checking and recording apparatus, workman's, C. P. Cottrell ... 1,274
Chuck, W. F. Schmidt ... 481,426
Cigar rolling machine, J. S. Winget ... 481,453
Circuit changing apparatus, A. D. Page ... 481,281
Cistern cleaner, E. B. Ravencroft ... 481,423
Clamp. See Dental clamp.
Cleaner. See Cistern cleaner.
Clevis and gauge wheel, combined, G. Moore ... 481,186
Closet. See Water closet.
Clothes drier, J. L. Mather ... 481,365
Clothes drier, E. Powell ... 481,189
Clutch, R. Shettler ... 481,205
Clutch, friction, F. H. Richards ... 481,194
Coal or ore jigger and washer, S. Stutz ... 481,438
Coin receptacle, pocket, F. H. Brown ... 481,523
Collar holder, shirt, F. L. Robinson ... 481,425
Commode, J. W. Clerke ... 481,256
Condenser head, S. H. Woodbridge ... 481,518
Corset, W. P. Bigelow ... 481,294
Cotton, pneumatic conveyer for unloading, G. A. Stafford ... 481,436
Countershaft supporting jack, H. J. Garbutt ... 481,486
Coupling. See Car coupling. Gas main safety coupling. Pipe coupling. Thill coupling.
Crank handle fastening, Heard & Birkinshaw ... 481,262
Culinary vessel, H. F. Thurston ... 481,316
Cultivator, W. Sobey ... 481,208
Cup. See Oil cup.
Curling iron, F. H. Deknatel ... 481,348
Cut-out, thermal, A. P. Seymour ... 481,246
Cutter. See Spoke tenon cutter.
Cutter bar, G. A. Vandament ... 481,318
Cylinder lock, J. B. Price ... 481,421
Cylinder mould, closed, F. X. Black ... 481,295
Dental clamp, J. S. Deardorff ... 481,479
Dental engine, F. A. Damon ... 481,164
Dice box, puzzle, H. Goujon ... 481 398
Die plate, L. C. Wetzel ... 481,450
Dock, hydraulic lifting, R. Moran ... 481,411
Door jamb setter, J. Ritterbeck ... 481,245
Door spring, J. A. Cooper ... 481,475
Draught attachment, spring, H. Barber ... 481,384
Draught equalizer, A. Hunt ... 481,357
Drier. See Clothes drier.
Drying apparatus, W. D. Sunderlin ... 481,212
Dust collector and conveyer, B. F. Mohr ... 481,185
Egg tester, J. B. Garland ... 481,487
Electric circuit controlling and interlocking apparatus, pneumatic, Slater & Barnes ... 481,430
Electric elevator, W. Baxter, Jr ... 481,386
Electric motor and generator, Bradley & Wood ... 481,220
Electric switch, J. H. Clark ... 481,297
Elevator. See Electric elevator.
End gate, Hawk & French ... 481,491
Engine. See Dental engine. Rotary fluid pressure engine.
Engraver's block, A. Muehlmatt ... 481,238
Exhaust head, J. L. Robertson ... 481,373
Extractor. See Spoke extractor.
Eyeglasses, A. H. Hartmann ... 481,400
Fabric. See Knit fabric. Waterproof fabric.
Fatty substances, purification of, J. Massignon ... 481,502
Ferrule, locking, A. G. Benson ... 481,462
Fertilizer distributer, Stahl & Johnston ... 481,209
Fertilizer distributer, R. B. Thomas ... 481,315
Fire escape, J. D. Brainard ... 481,222
Fishing reel, G. E. Medley ... 481,330
Fishing tackle, deep water, S. C. Darrow ... 481,165
Floor construction, fireproof, W. Orr ... 481,243
Floor jack, E. A. Bullock ... 481,470
Frame. See Picture frame.
Frame for pictures, etc., M. Reinfeld ... 481,333
Gaff hook, A. G. Benson ... 481,463
Gaff hook and landing net, combined, A. G. Benson ... 481,464
Gauge. See Marking gauge. Water gauge.
Garment supporter, G. J. Cline ... 481,256
Gas black machine, hydrocarbon, L. J. McNutt ... 481,240
Gas main safety coupling, A. Garretson ... 481,397
Gaseous fuel generator and burner, N. Horn ... 481,494
Gate. See Car gate. End gate.
Generator. See Fuel generator.
Girth, saddle, R. A. Lane ... 481,190
Grain binder, H. E. Pridmore ... 481,244, 481,530
Grain separator, J. Menge ... 481,366
Granite, etc., device for polishi g, G. L. Badger ... 481,341
Grate, fire, J. H. Mehrtens ... 481,237
Grinding cutlery and other handles, machine for, F. C Feicker ... 481,259
Grinding machine, O. S. Walker ... 481,380
Grinding mower knives, machine for, R. Dutton ... 481,275
Guard. See Railway stock and cattle guard.
Gun, breakdown, F. A. Hollenbeck ... 481,327
Gun, breakdown, T. Woodward ... 481,290
Gun, revolving magazine, T. Wilson ... 481,452
Hair clipper, C. Carleton ... 481,254
Handle. See Casket handle.
Harness pad, W. D. Underwood ... 481,289
Harvester, J. T. Mide ... 481,410
Harvester gear shifting mechanism, G. Schubert ... 481,202
Harvester reel support, J. F. Appleby ... 481,218
Harvester reel support, C. A. A. Rand ... 481,191
Hat supporter, W. Applegath ... 481,156
Hay carrier track, H. L. Ferris ... 481,349
Hay rack, H. S. Hoy ... 481,175
Hay rack, S. H. Plomberg ... 481,420
Hay rake, horse, W. R. Mann ... 481,501
Hay stack cutting machine, Evans & Douglass ... 481,393
Heater. See Water heater.
Heating apparatus, G. A. Watson ... 481,216
Heel plate, Ayres & Foster ... 481,324
Hinge, J. F. Hirst ... 481,492
Hitch, horse, A. Johnson ... 481,231
Holder. See Blacking holder. Collar holder. Napkin holder. Paper holder. Penholder. Pen and pencil holder. Pillow sham holder. Type holder. Yard stick holder.
Holder or rack, C. Warden ... 481,455
Hook. See Gaff hook.
Horse blanket fastener, C. A. Harvey ... 481,326
Horseshoe, O. E. Brown ... 481,271
Horseshoe toe calk, T. S. Very ... 481,336
Horseshoer's tool, O. Handeland ... 481,490
Hydrocarbon burner and device for automatically feeding the same, C. F. A. Convert ... 481,273
Identification device, B. H. Weeks ... 481,448
Indicator. See Train indicator.
Inkstand, L. B. Manley ... 481,408
Insulator, A. J. Wylie ... 481,457
Iron. See Curling iron.
Jack. See Countershaft supporting jack. Floor jack. Plug spring jack.
Joint. See Rail joint. Railway joint.
Knit fabric, J. F. Gee ... 481,351
Knob attachment, W. A. G. Ashley ... 481,510
Ladder, fire, Salyerds & Shadbolt ... 481,199
Lamp extinguisher, J. B. Price ... 481,268
Lamp shade, incandescent electric, Salick & Sipp ... 481,285
Lamps, reflecting shade for incandescent, L. T. Stanley ... 481,378
Lamps, reflecting shade for incandescent electric, L. T. Stanley ... 481,288
Lantern, tubular, J. S. Gall ... 481,276
Latch and lock, combined, J. A. Giese ... 481,261
Lathe, turret, J. Hartness ... 481,356
Lathes, stop mechanism for turret, F. H. Richards ... 481,192
Lawn sweeper, O. D. Thompson ... 481,269
Leather, composition for softening enameled, R. L. Tudor ... 481,516
Life-saving and pleasure craft, A. B. Shearer ... 481,427
Lifting machine, J. S. Crouch ... 481,224
Lock. See Bicycle lock. Cylinder lock. Nut lock. Safe lock. Seal lock.
Lock, J. Loch ... 481,235
Lock, J. B. Price ... 481,422
Locomotive fire boxes, brick arch for, F. W. Johnstone ... 481,232
Locomotives, starting gear for compound, R. Lindner ... 481,181
Log carrier, R. E. Terry ... 481,314
Loom picker, R. Wharton ... 481,339
Loom stop motion, W. M. Aikley ... 481,292
Lumber carriers, hanger for, J. E. Harder ... 481,355
Magnetic separator, G. Conkling ... 481,474
Mail bag thrower, Winsor & Cummings ... 481,322
Marker, gore, W. B. Kinsley ... 481,305
Marking gauge, J. A. Traut ... 481,515
Massage apparatus, A. Kahn ... 481,359
Mast arm, A. Wright ... 481,381
Match and toothpick machine, J. Boulard ... 481,522
Matrices, forming, C. L. Redfield ... 481,308
Measuring the velocity of fluids, gauge for, S. W. Robinson ... 481,310
Meat slicer, J. V. Bohannan ... 481,159
Mechanical movement, F. Meny ... 481,469
Mechanism, E. Patten ... 481,508
Mining machine, G. F. Myers ... 481,187
Mould. See Cylinder mould.
Monument, memorial, J. Mitchell ... 481,367
Motor. See Electric motor.
Mower, W. R. Baker ... 481,219
Mower grass receiver, lawn, F. L. Golibart ... 481,277
Musical instrument, multiplex, J. H. Wheeler ... 481,451
Napkin holder, I. T. Brown ... 481,161
Needle, ribbon, G. G. Welgand ... 481,338
Net bow or hoop, A. G. Benson ... 481,461
Nozzle, exhaust, P. Swenson ... 481,334
Nut and bolt wrench, J. Hoval ... 481,230
Nut blank threading device, J. C. Stuchel ... 481,437
Nut lock, J. Broadley ... 481,344
Nut lock, J. C. McQuilkin ... 481,417
Nut lock, A. Warenskjold ... 481,214
Oil cup, J. T. Smith ... 481,312
Ordnance, tool for boring breech-loading, G. Gerdom ... 481,300
Ores of zinc and lead, treating sulphide, Lewis & Petraeus ... 481,499
Ores, treating sulphide, Lewis & Petraeus ... 481,500
Oysters, apparatus for making fried, F. F. Warthen ... 481,337
Package for pulverized substances, J. Bina ... 481,521
Pad. See Harness pad.
Padlock, N. J. Zell ... 481,458
Painting with distemper and other colors, A. Pereira ... 481,282
Pan. See Bed pan.
Paper board tubs, manufacture of, W. W. McEwan ... 481,239
Paper feeding and cutting mechanism, R. T. Johnston ... 481,497
Paper hanging machine, L. D. Barton ... 481,251
Paper holder, L. Elias ... 481,167
Parallel bars, T. Peterson ... 481,509
Parer and corer, P. T. Gates ... 481,528
Pasting machine, bindery, J. L. Dennis ... 481,258
Pastry rack, portable, C. F. Jesser ... 481,404
Pegging jack support, W. M. Sawyer ... 481,374
Penholder, Blalock & Muir ... 481,158
Pen or pencil holder and making the same, H. T. Smith ... 481,534
Petroleum distillation, separation of waste products of, J. P. Engle ... 481,392
Petroleum, recovering waste products of, J. P. Engle ... 481,391
Picture frame, P. Wiener ... 481,217
Pillow sham holder, A. J. Robberson ... 481,424
Pipe coupling, D. A. Barnes ... 481,250
Pipe wrench, W. H. Dechant ... 481,257
Pipes, tapering tool for lead, M. Fritsche ... 481,169
Planing machine, L. T. Pyott ... 481,371
Planograph, self-recording, J. Soler ... 481,432
Planter, corn and seed, A. Griesemer ... 481,170
Planter, potato, C. Wright ... 481,456
Plow attachment, G. Watson ... 481,215
Plow planter attachment, J. P. Nugent ... 481,242
Plug spring jack, C. A. Shea ... 481,204
Polishing wheel, J. McClellan ... 481,415
Pressure regulating device, C. F. A. Convert ... 481,272
Printers' rollers, inclosure for packing and carrying, Bingham & Runge ... 481,465
Printing press folding attachment, R. C. Seymour ... 481,203
Protector. See Tree protector. Trolley protector.
Pulley, hay elevator, W. Louden ... 481,263
Pulley, sash, F. V. Phillips ... 481,510
Pulp machines, hydraulic feed for wood, J. T. Horton ... 481,174
Pulverizer, G. H. Smith ... 481,532
Racers, apparatus for starting, E. Forbes ... 481,260
Rack. See Hay rack. Pastry rack.
Rail joint, G. G. Stacy ... 481,433
Railway conduit, electric, W. F. Jenkins ... 481,403
Railway conduits, trolley for electric, W. F. Jenkins ... 481,402
Railway construction, W. J. Morden ... 1,368
Railway curve, cable, G. Muller ... 481,412
Railway grip, cable, G. & L. Schorpp ... 481,512
Railway joint, U. H. Hane ... 481,171
Railway stock and cattle guard, automatic, J. Walton ... 481,447
Railway switch, Peterson & Baland ... 481,267
Railway switch, automatic, W. Spielman ... 481,248
Railway time signal, S. Smith ... 481,533
Railway trolley, electric, W. F. Jenkins ... 481,401
Rake. See Hay rake.
Reaming and drilling machine, Opsion & Hooper ... 481,418
Reel. See Fishing reel. Wire reel.
Reel carrier, E. E. Kittleson ... 481,328
Register. See Cash register.
Roofing and siding, J. Winslow ... 481,541
Rotary fluid pressure engine, E. Towlson ... 481,441
Safe lock, J. White ... 481,319
Sand, plant for heating and controlling, F. V. Greene ... 481,489
Sash balance, N. Hamlet ... 481,302
Sash fastener, D. H. Taylor ... 481,440
Sash lift, H. E. Willer ... 481,320
Saw, D. C. Schlabach ... 481,201
Saw, cross-cut, I. S. Wilson ... 481,321
Saw set, Buence & Bash ... 481,221
Saw straining device, M. Jincks ... 481,496
Scraper, road, J. M. Brooks ... 481,160
Screw, L. H. Vinson ... 481,445
Screwdriver, changeable speed, H. Hubbell ... 481,304
Seal, S. E. Cheeseman ... 481,472
Seal lock, Simpson & George ... 481,206
Seat. See Vehicle jump seat.
Seats and valves, hardening, J. Powell ... 481,332
Seed delinting machine, cotton, J. H. McCormick ... 481,416
Seeding machine driving gear, T. H. Noxon ... 481,539
Separator. See Grain separator. Magnetic separator.
Sewing machine, E Patten ... 481,266
Shears, E. A. Sanders ... 481,200
Shingle scoring and marking machine, J. T. Rush ... 481,198
Ship conveyance, overland, W. R. Kinipple ... 481,408
Ship's log, J. S. Negus ... 481,241
Shirt, A. Meyere ... 481,504
Shoe horn, D. Cady ... 481,253
Shoe upper, J. C. Daggett ... 481,299
Signal. See Railway time signal.
Sled brake, P. T. Denio ... 481,480
Sole or heel plate, G. J. Davison ... 481,478
Spinning machine, Hunter & Avis ... 481,278
Spoke extractor, W. F. Bowe ... 481,342
Spoke tenon cutter, A. Bruner ... 481,469
Spring. See Door spring. Vehicle spring.
Spring coiling machine, spiral, J. Vermeulen ... 481,443
Springs, machine for knotting the ends of spiral, P. Fraser ... 481,396
Springs, machine for making spiral, P. Fraser ... 481,395
Stamp, hand, F. C. Lidke ... 481,362
Stamp, post office hand, E. J. Brooks ... 481,296
Steam, etc., apparatus for recordering and registering quantities of, F. Seiler ... 481,287
Steam trap, J. McKellar ... 481,507
Stone, composition of matter for the manufacture of artificial, Keseling & Fuchs, Jr ... 481,279
Stone paving block, artificial, F. Haines ... 481,352 to 481,354
Store service apparatus, J. J. Crist ... 481,346
Stove, I. De Haven ... 481,226
Stove, culinary and heating oil, V. E. Randall ... 481,511
Strainer, lid, H. S. Diack ... 481,166
Structural blank, E. C. Smith ... 481,207
Structure, circular roofed, C. Cunningham, Jr ... 481,347
Stuffing box, C. K. Longenecker ... 481,406
Supporter. See Garment supporter. Hat supporter. Umbrella supporter.
Suspender end attachment, J. Lees, Jr ... 481,360
Suspension device, G. W. Baldwin ... 481,157
Swing, J. B. Sweetland ... 481,439
Switch. See Railway switch. Trolley switch.
Tablet, memorandum, G. H. Seymour ... 481,429
Tag fastener, O. E. Abbey ... 481,382
Telegraph, ship's, A. B. W. H. Cords ... 481,223
Telegraphy, J. G. Smith ... 481,247
Telephone, A. Rettig ... 481,284
Telephone arm rest, Bailey & Lincoln ... 481,293
Telephone system, R. N. Dyer ... 481,483
Telephony, J. W. Gibboney ... 481,529
Thill coupling, A. L. Straw ... 481,436
Thrashing machine belt tightener, E. Huber ... 481,176
Ticket, time limit, J. H. Stedman ... 481,210
Tire, cycle, Stone & Corser ... 481,435
Tire, pneumatic, C. H. Roth ... 481,197
Tire, pneumatic, A. F. Wyman ... 481,323
Tool holding device, F. H. Richards ... 481,193
Toy, flying, E. R. Lochmann ... 481,182
Train indicator, H. L. Mantoon ... 481,364
Trap. See Bedbug trap. Steam trap.
Tray and egg tester, combined dumping, J. B. Garland ... 481,488
Tree protector, fruit, A. B. Smith ... 481,311
Trip slip, conductor's, E. H. Murdock ... 481,369
Trolley protector, J. Walsh ... 481,517
Trolley switch, J. S. Merkins ... 481,503
Tug, harness, S. P. Chandler ... 481,471
Twisting machine, skein, L. Dimock ... 481,227
Type holder, L. K. Scotford ... 481,286
Typewriting machine, J. D. Daugherty ... 481,477
Typewriting machine, C. L. Redfield ... 481,309
Typewriting machine, C. Spiro ... 481,376, 481,377
Type writing machines, aligner for, F. M. Spaulding ... 481,513
Umbrella ribs and stretchers, guide for, H. G. Praetorius ... 481,283
Umbrella supporter, J. Devereaux ... 481,481
Universal jointed brace, A. C. Derlon ... 481,526
Valve, ball cock, W. A. Turner ... 481,317
Valve, reversing, J. Clark ... 481,162
Valve, steam-actuated, E. Bartholomew ... 481,520
Vehicle brake, E. W. Broadhead ... 481,466
Vehicle, jump seat, G. H. Hutton ... 481,358
Vehicle spring, G. W. Farrell ... 481,394
Vehicle spring, D. C. Hamlin ... 481,303
Velocipede, A. C. Shelley ... 481,428
Vending apparatus, coin-controlled, A. S. Kibby ... 481,280
Vending machine, coin-controlled, E. L. Pickard ... 481,331
Ventilator. See Car ventilator.
Vise, pipe tongs, and cutter, combined, J. Ellis ... 481,168
Washing machine, S. P. Lowell ... 481,183
Washing machine, I. B. Owens ... 481,419
Water closet, G. J. Kremelberg ... 481,498
Water gauge, J. A. & J. Hopkinson ... 481,493
Water heater, Stees & Graupensperger ... 481,211
Water heater, electric, T. Abearn ... 481,291
Waterproof fabric, J. R. France ... 481,485
Weather strip, A. M. Ewers ... 481,229
Well drilling machine, J. W. Draper *et al* ... 481,482
Wheel. See Barrow wheel. Bicycle wheel. Polishing wheel.
Wheel rim and tire, C. E. W. Woodward ... 481,340
Whiffletree connection, A. Haggerty ... 481,301
Winding machines, driving mechanism for the spindles of circular, F. A. Ludwig ... 1,329
Wire box strap machine, J. Vermeulen ... 481,444
Wire reel, Miller & Bowman ... 481,306
Wire stretcher or clamp, J. M. Klein ... 481,179
Wrench. See Nut and bolt wrench. Pipe wrench.

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Wrench, E. A. Cochran 481,389
Wrench, B. McGilvray 481,506
Yard stick holder, E. R. Northam 481,188

DESIGNS.

Badge, G. B. Rand 21,790
Box, E. L. Button 21,796
Buckle, suspender, C. R. Harris 21,791
Button hook, C. Wester 21,792
Cane handle, F. S. Evans 21,784
Fabrics, ornamentation of, H. Sturm 21,795
Flag, J. W. MacNamara 21,788
Hat rack, J. Honecker 21,781
Horn, campaign, H. L Millis 21,789
Knife handle, H. A. Weihman 21,785
Lathe bed, C. M. Conradson 21,798, 21,799
Sign, barber's, Svoboda & Hofmann 21,782
Spoon, J. A. Hughes 21,783
Statute, C. Holloway 21,787
Stove, heating, W. N. Moore 21,801
Trimming, A. S. Ellison 21,793
Trimming, dress, H. W. Schloss 21,794
Vending machines, casing for coin-actuated, R. H. Little 21,786
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Cigars, C. Alvarez 21,691
Cigars, Diaz y Hermano 21,658
Cigars, R. Lopez 21,661
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Scalp wash, L. A. Smith 21,654
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Sirup, worm, Dr. David Kennedy Corporation 21,657
Soap, laundry, Benjamin Brooke & Company 21,671, 21,676
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Tin and roofing plates, Cleveland Tin Plate Co 21,656
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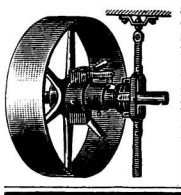
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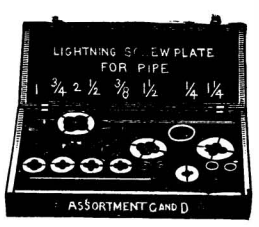

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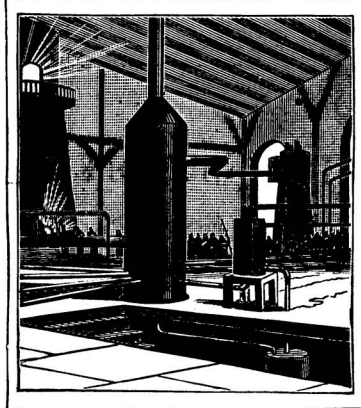
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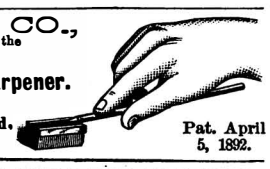
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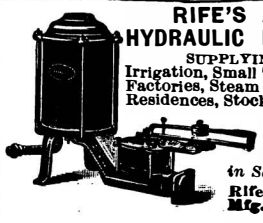
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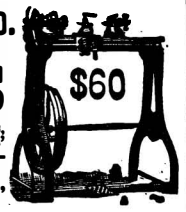

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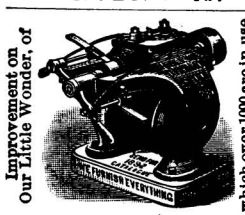

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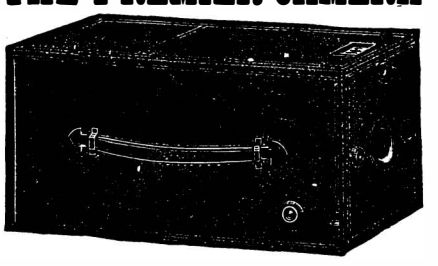
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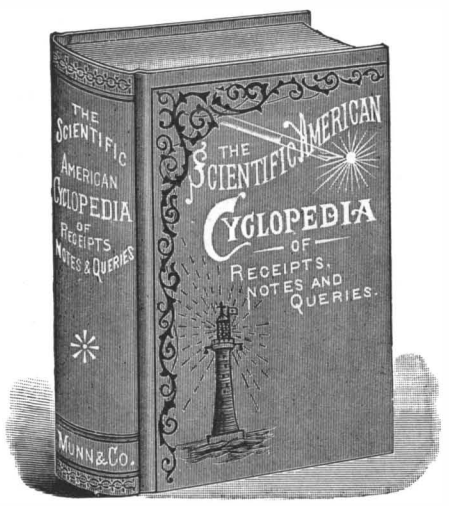

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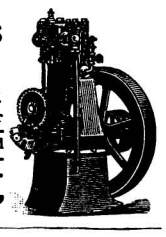

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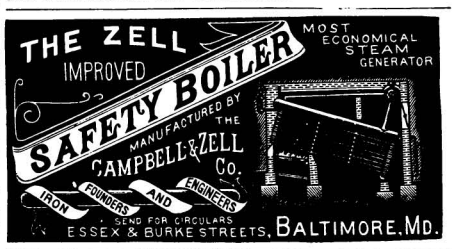

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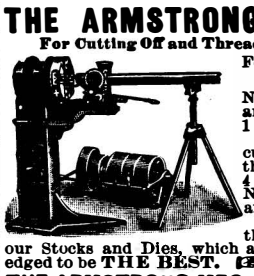

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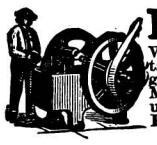

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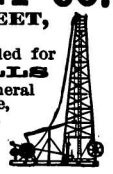

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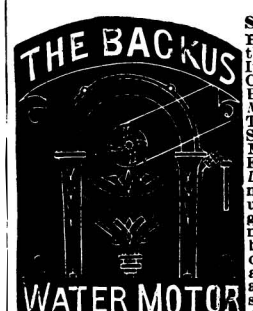

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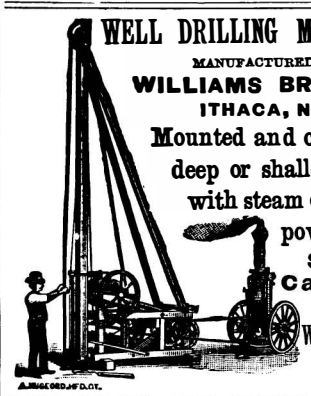

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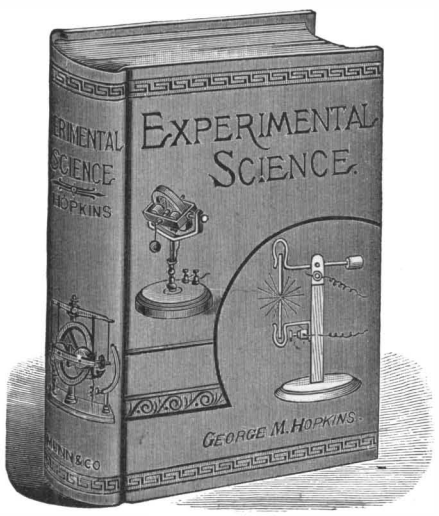

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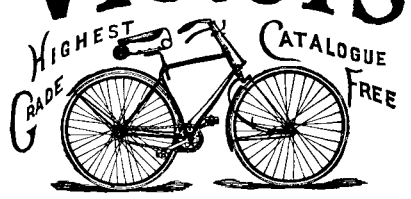

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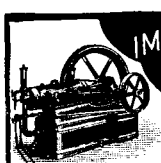

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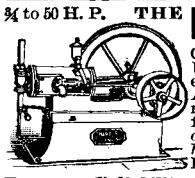

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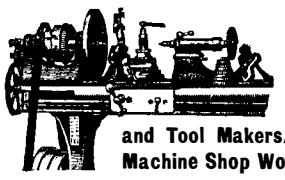

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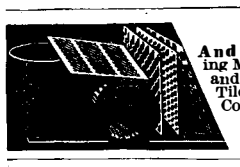

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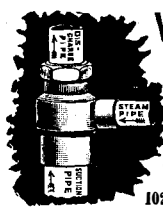

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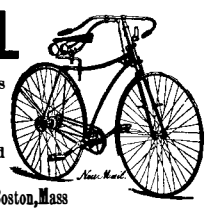

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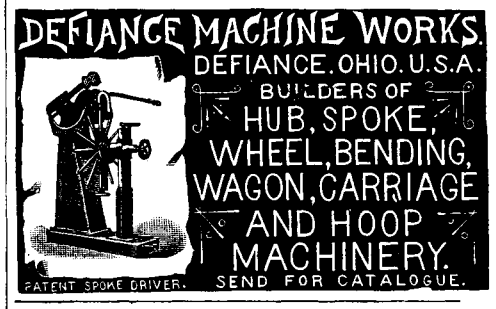

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